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HOW TO CONDUCT MILK AND CREAM CONTESTS¹

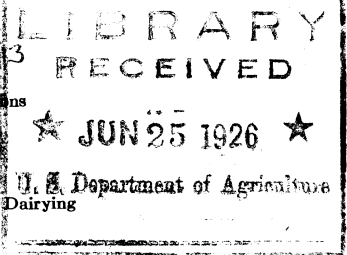
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Milk and cream contests of various kinds are being used to advantage in milk-improvement programs and as a part of the regular inspection systems. The competitive spirit, introduced in this manner, is employed to constructive purpose, and the producer's interest in better milk is awakened and intensified. The dairyman who furnishes a product of high quality is rewarded by recognition of his service, and the dairyman of less careful habits is spurred to greater endeavor. In extreme cases those who insist on producing an inferior product are eliminated, for consumers are more discriminating when they become better informed about milk qualities.

COMPOSITE SCORE THE BASIS OF COMPARISON

In milk and cream contests, as they are considered in this publication, total scores obtained by the use of a score card embracing several factors are used as a basis of comparison. Milk to be used for special purposes in manufacturing is sometimes selected by submitting it to only one test, such as a bacteria count, a test for sediment, or the Babcock test. But when milk from one dairy is scored against that from another to determine which is of higher all-around quality, a comprehensive test is needed. This is best shown by a score in which ratings on several points are combined.

¹ This circular is a revision of and supersedes Department Circular 53, entitled "Milk and Cream Contests," by Ernest Kelly and George B. Taylor.

SCORE CARDS FOR MILK AND CREAM

Score cards used in the United States for scoring milk usually take into consideration its flavor and odor, the bacteria, sediment, fat, and solids not fat which it contains, its temperature, acidity, or some other factor denoting keeping quality, and the appearance of the bottle and cap. The cards for scoring market cream are similar except that solids not fat are disregarded. A perfect score is 100. The weights usually given to the different factors are shown on the cards reproduced here. They are more or less arbitrary.

[Front]

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF DAIRYING

SCORE CARD FOR MILK

Place.....
Class..... Exhibit No.....

	Perfect score	Score allowed	Remarks
Bacteria.....	35		Bacteria found per cubic centimeter
Flavor and odor.....	15		Cowy, bitter, feed, flat, strong, cooked
Sediment.....	10		
Fat.....	15		Per cent.....
Solids not fat.....	15		Per cent.....
Temperature (street samples) or Acidity (prepared samples).....	5		Degrees..... or Per cent.....
Bottle and cap.....	5		Bottle..... Cap.....
Total.....	100		

Exhibitor.....
Address.....

(Signed)

Date.....

Judges.

[Back]

DIRECTIONS FOR SCORING

BACTERIA PER CUPIC CENTIMETER—PERFECT SCORE, 35

	Points		Points
500 and under.....	35	18, 001-19, 000.....	31.3
501-1, 000.....	34.9	19, 001-20, 000.....	31.1
1, 001-1, 500.....	34.8	20, 001-21, 000.....	30.9
1, 501-2, 000.....	34.7	21, 001-22, 000.....	30.7
2, 001-2, 500.....	34.6	22, 001-23, 000.....	30.5
2, 501-3, 000.....	34.5	23, 001-24, 000.....	30.3
3, 001-3, 500.....	34.4	24, 001-25, 000.....	30.1
3, 501-4, 000.....	34.3	25, 001-30, 000.....	28.6
4, 001-4, 500.....	34.2	30, 001-35, 000.....	27.1
4, 501-5, 000.....	34.1	35, 001-40, 000.....	25.6
5, 001-6, 000.....	33.9	40, 001-45, 000.....	24.1
6, 001-7, 000.....	33.7	45, 001-50, 000.....	22.6
7, 001-8, 000.....	33.5	50, 001-55, 000.....	20.6
8, 001-9, 000.....	33.3	55, 001-60, 000.....	18.6
9, 001-10, 000.....	33.1	60, 001-65, 000.....	16.6
10, 001-11, 000.....	32.9	65, 001-70, 000.....	14.6
11, 001-12, 000.....	32.7	70, 001-75, 000.....	12.6
12, 001-13, 000.....	32.5	75, 001-80, 000.....	10.6
13, 001-14, 000.....	32.3	80, 001-85, 000.....	8.6
14, 001-15, 000.....	32.1	85, 001-90, 000.....	6.6
15, 001-16, 000.....	31.9	90, 001-95, 000.....	4.6
16, 001-17, 000.....	31.7	95, 001-100, 000.....	2.6
17, 001-18, 000.....	31.5	Over 100,000.....	0

NOTE.—When the number of bacteria per cubic centimeter exceeds the local legal limit for the grade in which the milk is entered, the score shall be 0.

FLAVOR AND ODOR—PERFECT SCORE, 15

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

SEDIMENT—PERFECT SCORE, 10

Examination for sediment may be made by means of a sediment tester, and the resulting cotton disks compared with standards; or the sediment may be determined by examination of the bottom of the milk in the bottle. In the latter case the milk should stand undisturbed for at least an hour before the examination. Raise the bottle carefully in its natural upright position until higher than the head. Tip slightly and observe the bottom of the milk with the naked eye with 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 quantity of sediment found. When possible, the nature of the sediment should be described under "Remarks."

FAT IN MILK—PERFECT SCORE, 15

Anything below the local legal minimum shall be scored 0. City, State, or contest officials shall decide the percentage of fat to be allowed a perfect score and shall indicate the gradations in score between 0 and 15 points.

SOLIDS NOT FAT—PERFECT SCORE, 15

Anything below the local legal minimum shall be scored 0. City, State, or contest officials shall decide the percentage of solids not fat to be allowed a perfect score, and shall indicate the gradations in score between 0 and 15 points.

TEMPERATURE (STREET SAMPLES)—PERFECT SCORE, 5

	Points		Points
50 degrees F. and below.....	5	57 to 60 degrees.....	1
51 to 53 degrees.....	4	Above 60 degrees.....	0
54 to 56 degrees.....	3		

ACIDITY (PREPARED SAMPLES)—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

Deductions in score should be made for dirty or chipped bottles; and for caps which do not cover the lips of the bottles, or do not fit properly in the cap seats.

[Front]

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF DAIRYING

SCORE CARD FOR CREAM

Place.....

Class..... Exhibit No.....

Item	Perfect score	Score allowed	Remarks
Bacteria.....	35	-----	Bacteria found per cubic centimeter.
Flavor and odor.....	25	-----	Cowy, bitter, feed, flat, strong.
Sediment.....	10	-----	-----
Fat.....	20	-----	Per cent.
Temperature (street samples).....	5	-----	Degrees
or		-----	-----
Acidity (prepared samples).....	5	-----	Per cent.
Bottle and cap.....	5	-----	Bottle
		-----	Cap.
Total.....	100	-----	

Exhibitor.....

Address.....

(Signed)

Judges.

Date.....

[Back]

DIRECTIONS FOR SCORING

BACTERIA PER CUBIC CENTIMETER—PERFECT SCORE, 35

	Points		Points
500 and under.....	35	25,001-30,000.....	29
501-1,000.....	34.9	30,001-35,000.....	28
1,001-1,500.....	34.8	35,001-40,000.....	27
1,501-2,000.....	34.7	40,001-45,000.....	26
2,001-2,500.....	34.6	45,001-50,000.....	25
2,501-3,000.....	34.5	50,001-55,000.....	24
3,001-3,500.....	34.4	55,001-60,000.....	23
3,501-4,000.....	34.3	60,001-65,000.....	22
4,001-4,500.....	34.2	65,001-70,000.....	21
4,501-5,000.....	34.0	70,001-75,000.....	20
5,001-6,000.....	33.8	75,001-80,000.....	19
6,001-7,000.....	33.6	80,001-85,000.....	18
7,001-8,000.....	33.4	85,001-90,000.....	17
8,001-9,000.....	33.2	90,001-95,000.....	16
9,001-10,000.....	33.0	95,001-100,000.....	15
10,001-11,000.....	32.8	100,001-120,000.....	12.5
11,001-12,000.....	32.6	120,001-140,000.....	10.0
12,001-13,000.....	32.4	140,001-160,000.....	7.5
13,001-14,000.....	32.2	160,001-180,000.....	5.0
14,001-15,000.....	32.0	180,001-200,000.....	2.5
15,001-20,000.....	31.0	Above 200,000.....	0
20,001-25,000.....	30		

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."

SEDIMENT—PERFECT SCORE, 10

Examination for sediment should be made only after the cream has stood for at least an hour undisturbed in any way. Raise the bottle carefully in its natural upright position until higher than the head. Tip slightly and observe the bottom of the cream 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 quantity of sediment found. When possible the nature of the sediment should be described under "Remarks."

FAT IN CREAM—PERFECT SCORE, 20

Points	Points
25 per cent and above..... 20	19 per cent..... 17
24 per cent..... 19.5	18 per cent..... 16
23 per cent..... 19	17 per cent..... 12
22 per cent..... 18.5	16 per cent..... 8
21 per cent..... 18	15 per cent..... 4
20 per cent..... 17.5	Less than 15 per cent..... 0

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

TEMPERATURE (STREET SAMPLES)—PERFECT SCORE, 5

Points	Points
50 degrees F. and below..... 5	57 to 60 degrees..... 1
51 to 53 degrees..... 4	Above 60 degrees..... 0
54 to 56 degrees..... 3	

ACIDITY (PREPARED SAMPLES)—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

Deductions in score should be made for dirty or chipped bottles; for caps which do not cover the lips of the bottles, or do not fit properly in the cap seats.

CHARACTER OF CONTESTS

Milk and cream contests may be classified in general as (1) those in which the samples are submitted voluntarily, and (2) surprise contests in which samples are unexpectedly collected from the distributor or producer. Both kinds of contests may be varied to suit special conditions, but usually the samples submitted voluntarily are specially prepared by the exhibitor, whereas in surprise contests the samples are selected at random by an inspector from the milk offered for sale.

The scores on specially prepared samples of milk and cream may or may not indicate the quality of the product regularly sold. The results of contests in which samples of that type are entered may even give the winner some undeserved advertising. And yet especially when contests of this kind are first held in a community or a larger territory, they do have considerable educational value because they show that milk of high quality can be produced by observing certain simple rules. Dairymen who submit samples in several contests usually obtain successively higher scores. After contests of this character have been held a number of times in one locality, there is a tendency for the prizes to be consistently captured by a few individuals. When this occurs, the general value of the contest is much reduced.

Surprise contests, on the other hand, are a means of determining fairly the average quality of the milk which each distributor is selling. The average scores given the dairymen are usually based on several samples collected at irregular intervals over a period of months and are therefore cumulative and representative. Well-organized inspec-

tion departments usually give the dairymen reports on each sample soon after it is collected, and if it is unsatisfactory there is a chance for improvement before another is collected. For this reason an excellent opportunity for doing educational work is offered to the inspector. This, coupled with the public recognition given dairymen who produce a superior product, has helped to obtain marked improvement in the quality of milk and cream in cities and communities where surprise contests have been made a part of the regular inspection program.

The territory that may be covered by a surprise contest is somewhat limited, because of difficulty in having samples collected by disinterested parties and delivered in a satisfactory manner to a laboratory for scoring. But they can be and are being held in cities, regardless of size; by groups of small cities situated near each other; and even by whole counties where county health authorities supervise the milk supplies of all the towns and cities in their territory.

CONTESTS IN WHICH SAMPLES ARE SUBMITTED BY CONTESTANTS

In contests in which the samples usually are specially prepared, the first step is the appointment of a superintendent responsible for all the details. If money has been provided for medals or prizes, the superintendent's first task is made much easier; otherwise, before he proceeds further, he should determine what inducements it will be possible to offer to the exhibitors. Some producers are glad to enter in the hope that their products will be placed high; but prizes, medals, or even diplomas of merit provide an additional incentive and aid in increasing the number of exhibitors. In local contests, organizations and commercial firms may easily be persuaded to give prizes.

The second task of the superintendent is to prepare notices of the contest, stating where it is to be held; prizes to be offered; names of the judges, if possible; where the samples are to be shipped; where entry blanks and shipping tags may be obtained; date on which all samples must be produced; and other detailed information. These notices may be published in the press; but the individual notices distributed to dairymen through State and city inspection departments, agricultural college officials, and organizations of producers and distributors are usually very effective. Many times it is found advantageous to inclose with the notice an entry blank and shipping tag which the superintendent has had printed. It should be made a prerequisite of the contest that this entry blank be filled out by the contestant and sent to the superintendent.

How to Conduct Milk and Cream Contests

7

SAMPLE ENTRY BLANK

DEPARTMENT OF HEALTH

CITY OF

OFFICIAL ENTRY BLANK

MILK AND CREAM CONTEST

Held at from to
(Place)

Under the direction of

The following classes are provided:

- Class I. Raw market milk.
- Class II. Certified milk.
- Class III. Pasteurized market milk.
- Class IV. Raw market cream.
- Class V. Pasteurized market cream.

RULES

1. Competition is open to all milk and cream producers and distributors supplying milk and cream to.....
2. Only one entry may be made in any one class.
3. Producers of certified milk are barred from competition in any other class.
4. All samples of certified milk must be accompanied with a certificate issued by the medical milk commission under whose supervision the milk is produced.
5. Entries in milk classes consist of 4 pints of milk in pint bottles.
6. Entries in cream classes consist of four one-half pints of cream in half-pint bottles.
7. All entries of milk and cream after scoring become the property of the department of health of.....
8. No contestant will be entitled to placing who does not make answer to each question herein given, sign declaration and forward this official entry blank to.....
(Name.) (Address.)

HOW TO COMPETE

Milk or cream to compete in this contest must be delivered or shipped, prepaid, to.....
In order that all milk and cream entered by contestants may be of the same age when scored, all samples must be produced or prepared on.....
(Date)

and shipped immediately. Bottles should be carefully packed in ice in a proper shipping box, and this box marked plainly on the inside cover as well as on the outside, with the owner's name and address.

An official representative of the judges will receive all samples and place them at once in cold storage.

APPLICATION AND QUESTIONS TO BE ANSWERED

Please enter for me four (pint) bottles of..... to com-
($\frac{1}{2}$ pint)
pete in class in accordance with conditions herein prescribed.

FOR CLASSES I, II, AND IV

1. On what day and hour was the sample entered in this contest drawn?.....
2. How many cows contributed to the sample of milk entered?.....
3. What kind and quality of feed was given cows daily during the week preceding the production of the sample?.....
4. How were cows cleaned previous to milking?.....
5. What kind of pail was used, small-top or open?.....
6. Was milking machine used?.....
7. How were the utensils sterilized?.....
8. What method of straining was used?.....
9. How was the milk cooled?.....
How long after milking?.....
To what temperature?.....
10. Were these samples prepared with equipment used regularly?.....
11. Have you previously exhibited milk or cream at any local, State, or national show?.....
12. (Additional for cream.) How was the sample separated?.....
How was the separator cleaned?.....
13. (Additional for certified.) Give name and address of medical milk commission certifying to your product.....

FOR CLASSES III AND V

14. When was the sample pasteurized?.....
15. What was the average age of the product at the time of pasteurization?.....
16. Did you use a clarifier?.....
17. To what temperature was the product heated?.....
18. How long was it held at that temperature?.....
19. Do you use automatic temperature control and recording thermometers?.....
20. To what temperature was the product cooled?.....
21. How was the pasteurizing apparatus cleaned?.....
22. Was your regular pasteurizing equipment used in preparing these samples?.....

I,, do hereby declare each and every statement in answer to the foregoing questions to be true. I do furthermore declare that the product submitted by me is the pure natural product, free from preservatives, and (for Classes I, II, and IV) that it has not been heated or changed in any way.

(Name).....
(Address).....

Date.....

Do you wish shipping box returned at your expense?.....

PREPARATION OF SAMPLES

The superintendents of contests in which specially prepared samples are entered may issue brief instructions on how to prepare the milk for entry, or they may see that literature on clean milk production is made available to the producers. Where entry blanks are distributed through local inspectors, these officials may be of assistance in showing the dairymen what methods to use. If the contest is to be of most value, it should be made clear that the samples are to be taken from milk that has been handled over the regular equipment and be taken from at least several cows. Care should also be taken that the producer understands that in order to produce clean milk with a low bacteria count it is necessary that all equipment with which the milk comes in contact be as nearly sterile as possible; that the udders of the cows and the hands of the milkers be thoroughly washed; that small-top pails be used; and that sterile absorbent cotton or filter cloth be used to give the most satisfactory results in straining milk. Cooling the milk soon after it is drawn should be stressed. It is advisable to cool milk before putting it in bottles, for otherwise it will shrink, and the bottle will not be full. This not only will detract from the score on bottle and cap, but also may allow the milk to churn en route.

The cold milk should be put in milk bottles which have been selected for clearness of glass and absence of imperfections, such as chipped mouths, stains, or foreign material. The bottles should then be carefully capped, if possible, with a mechanical capper. If ordinary milk-bottle caps are used a waterproof cover should be securely fastened over the top of each bottle to protect the pouring lip from contamination. If sterile caps are not available suitable ones may be prepared by dipping them in hot paraffin. Unparaffined caps should not be used, for they are apt to injure the flavor of the milk. More bottles than are needed should be filled, so that the ones with the most satisfactory appearance may be selected for entry in the contest.

PACKING AND SHIPPING SAMPLES

Special care must be taken in packing and labeling the samples. In local contests the contestants usually bring in their own samples properly iced; but when shipping is necessary, special care should be taken to pack the samples so that they will remain cold and the bottles will not be broken. Some system of packing must be used that will hold the bottles firmly in place without injuring the caps. One method is to place the samples in a small, close-fitting container which in turn is securely fastened in an insulated or tight wooden box containing ice. The outer box may be insulated with cork or sawdust and should have a tight-fitting lid. The lid should not be fastened on with screws, but should be hinged and provided with eye and staple fastener, unless it is not to be returned, in which case it may be nailed. The owner's name and address should be plainly written on the inside of the cover of the outer box and the samples must be labeled with the name or number of the class in which they are to be entered. The package must be plainly addressed on the outside to the consignee and also bear the sender's name and address. Shipping charges must be prepaid.

HANDLING SAMPLES AT DESTINATION

When the samples reach their destination they should immediately be put into cold storage at a temperature between 35 and 40° F. until the time of examination. When the shipping boxes are opened the name and address of the consignor are recorded, and the samples which he enters in each class are given a number. The name of the contestant, the class of the product, and the number given the sample are recorded in a book or on a blank under the proper class. It is well to use a separate page or sheet for each class of product, and as the bottles are unpacked they should be grouped according to classes. Thus all samples entered in Class I will be placed in one row, the bottles in each entry together; those in Class II in another row; and so on. The samples in each class are then scored in groups, which is much fairer than scoring one class against another. Care must be taken that all competing samples, as those in one class for example, be of the same age when analyzed or scored. The person in charge of the contest should keep the records, and it is desirable for the judges to know the samples only by numbers.

As there are four bottles in each entry, one may be used for bacterial and chemical analysis, one for appearance and sediment, one for judging flavor and odor, and one held in reserve to be placed on exhibition. This method may be varied to meet special conditions.

The best sample in each class must be declared the winner of that class, provided that all conditions have been met. In case of ties in the total score, the entry having the lowest bacteria count should outrank the others. Samples of high quality that have not won a prize may be awarded a diploma of merit. A form similar to the following may be used:

DIPLOMA OF MERIT

(Name of organization)

Accords Special Recognition
to

For a sample of _____ scoring _____ exhibited
at the _____ held at _____

Judges:

(Signed) _____

[SEAL]

Superintendent of Contest.

SURPRISE CONTESTS

Surprise contests are conducted with samples collected from the distributors without previous notice. Usually they are collected from the wagons, but may be taken directly from the storage room of the dairy or from the sales counter. The most important requirement from the standpoint of fairness is that the samples, when collected, be as nearly as possible in the condition in which they would have reached the consumer. It is not customary to collect samples from such places as groceries and lunch counters for use in contests, because the dairy, in most cases, has no control over the care taken of the milk after such agencies receive it. Sellers of this class present a different milk-control problem and must be dealt with more or less directly.

Samples should be collected at least once a month, and oftener if possible. The temperature of the milk should be taken at the time of collection. The bottles which are opened for that purpose are not used for bacteriological examination, but may be plainly labeled and kept for chemical analysis or given back to the dairyman. It may not be possible to collect a number of samples in proportion to the total quantity delivered, but enough samples should be collected to represent fairly the output of the dairy for that day.

The person who collects the samples should be provided with a carrying case containing cracked ice, in which the bottles may be placed immediately and kept until they are transferred to some other container in which they are iced, or until the milk is analyzed and scored. This is very important, and dairymen have a right to insist that it be done.

The surprise contest is continuous. The samples are analyzed at frequent intervals, but the results are summarized and ratings given only occasionally, at which time the scores on flavor, odor, sediment, and bottle and cap are included. All analyses made by the health office or inspection department are included in the averages compiled at the time the check analyses and scores are made by the judges.

When the milk is to be scored for flavor and odor, sediment, and condition of bottle and cap, it is necessary to collect two bottles for samples. Most inspection departments prefer, however, to make only bacteria counts, fat tests, and specific-gravity readings regularly, and to make the other tests only occasionally. In this case, it is necessary to collect only one sample in addition to the one from which the temperature is taken.

When the time comes for scoring, samples from all the distributors are scored and tested in one or two days, and the results are combined and averaged with records of samples collected since the last scoring was held. More than one sample is usually scored from the larger dairies. It is customary for the inspection department responsible for the contest to ask one or more qualified milk judges, such as State, United States Government, or city dairy officials, to assist in scoring the samples and making the bacterial and chemical tests at the time the scoring is held. This provides unprejudiced opinion and serves as a check on the laboratory work done between scorings.

Careful records of all determinations should be made and properly filed. The kind of form to use will depend upon conditions, but blanks in a loose-leaf ledger, of form similar to that shown herewith, may be used advantageously.

As in the contests in which prepared samples are entered, the records of milk or cream in different classes should be kept separately. Some dairies may distribute milk and cream of several different grades or classes, and in that case a separate blank should be used for each one. Records on different grades or classes should not be averaged together to obtain a total score. After all averages are made, the score cards filled out, and total scores computed, the winner of the contest in each class is determined in the same manner as in contests in which the samples are specially prepared.

When surprise contests are included in the regular milk-control program they should be held at least twice a year. Some cities and localities find it advantageous to hold the contests three times a year. The contests usually are not held at exactly regular intervals, but the time is regulated so that the element of surprise is not eliminated.

ANNOUNCEMENT OF RATINGS

When surprise contests are first adopted in a locality, it is well to let it be known that the results of contests will eventually be published. Then after the first contest is held and the distributors have been given their scores and the range of all the scores it is well to call a meeting of all those interested to discuss practical methods of producing milk which will score higher. Usually it is not good policy to publish the results of the first contest, but to give the distributors time to make necessary adjustments. After the results of later contests are published, the distributors who obtain low scores usually call upon the local inspector for suggestions on how to improve the quality of their product.

The scores, in the order of merit, may be published opposite the names of those receiving them, or the contestants may be grouped. For instance, all those scoring above 95 may be in one group; those between 90 and 95, between 80 and 90, between 70 and 80, and so on, in other groups. The grouping is more difficult, however, when there are several classes of product, for the scores on each class must be grouped separately in the published account. Each class, such as pasteurized, raw, etc., should be reported separately and distinctly from each other class, as comparisons between classes are misleading.

METHODS OF ANALYZING AND TESTING

It is of special importance in all analytical work that standard methods be followed. No attempt is made here to give details of milk analysis, as every laboratory equipped to do this kind of work must certainly contain the proper reference books. Besides the usual books found in all health or food laboratories, the analyst should have the following pamphlets:

Chemical Testing of Milk and Cream, Bureau of Animal Industry Leaflet A-12,
U. S. Department of Agriculture, Washington, D. C.
Standard Methods of Milk Analysis, American Public Health Association and
Association of Official Agricultural Chemists.

SPECIFIC GRAVITY

The determination of specific gravity may be made by means of an accurately graduated lactometer. It should be ascertained to a certainty that the lactometer is accurate, for many times even new

lactometers will vary considerably. State laboratories usually will check lactometers, or the Bureau of Standards, Washington, D. C., will do it for a nominal fee. The importance of accuracy in taking the specific gravity is better understood when it is realized that the lactometer reading is used in calculating the total solids and solids not fat (fig. 1). As most of the lactometers are standardized to 60° F. (15° C.) the temperature of the milk to be tested should closely approximate this temperature. If it is necessary to take the readings at some other temperature, the following table of corrections may be used:

Table for correcting the lactometer reading according to temperature

Degrees of lactometer	Degrees of thermometer (Fahrenheit)															
	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
20	19.0	19.0	19.1	19.1	19.2	19.2	19.3	19.4	19.4	19.5	19.6	19.7	19.8	19.9	19.9	-----
21	19.9	20.0	20.0	20.1	20.2	20.3	20.3	20.4	20.5	20.6	20.7	20.8	20.9	20.9	20.9	-----
22	20.9	21.0	21.0	21.1	21.2	21.2	21.3	21.3	21.4	21.5	21.6	21.7	21.8	21.9	21.9	-----
23	21.9	22.0	22.0	22.1	22.2	22.2	22.3	22.3	22.4	22.5	22.6	22.7	22.8	22.8	22.9	-----
24	22.9	22.9	23.0	23.1	23.2	23.2	23.3	23.3	23.4	23.5	23.6	23.6	23.7	23.8	23.9	-----
25	23.8	23.9	24.0	24.0	24.1	24.1	24.2	24.3	24.4	24.5	24.6	24.6	24.7	24.8	24.9	-----
26	24.8	24.9	24.9	25.0	25.1	25.1	25.2	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	-----
27	25.8	25.9	25.9	26.0	26.1	26.1	26.2	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	-----
28	26.7	26.8	26.8	26.9	27.0	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	-----
29	27.7	27.8	27.8	27.9	28.0	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	-----
30	28.6	28.7	28.7	28.8	28.9	29.0	29.1	29.1	29.2	29.3	29.4	29.6	29.7	29.8	29.9	-----
31	29.5	29.6	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.8	30.9	-----
32	30.4	30.5	30.5	30.6	30.7	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.9	-----
33	31.3	31.4	31.4	31.5	31.6	31.8	31.9	32.0	32.1	32.3	32.4	32.5	32.6	32.7	32.9	-----
34	32.2	32.3	32.4	32.4	32.5	32.7	32.9	33.0	33.1	33.2	33.3	33.5	33.6	33.7	33.9	-----
35	33.0	33.1	33.2	33.4	33.5	33.6	33.8	33.9	34.0	34.2	34.3	34.5	34.6	34.7	34.9	-----

Degrees of lactometer	Degrees of thermometer														
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
20	20.1	20.2	20.2	20.3	20.4	20.5	20.6	20.7	20.9	21.0	21.1	21.2	21.3	21.5	21.6
21	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	22.0	22.1	22.2	22.3	22.4	22.5	22.6
22	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	23.0	23.1	23.2	23.3	23.4	23.5	23.7
23	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	24.0	24.1	24.2	24.3	24.4	24.6	24.7
24	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.9	25.0	25.1	25.2	25.3	25.5	25.6	25.7
25	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.9	26.0	26.1	26.2	26.4	26.5	26.6	26.8
26	26.1	26.2	26.3	26.5	26.6	26.7	26.8	27.0	27.1	27.2	27.3	27.4	27.5	27.7	27.8
27	27.1	27.3	27.4	27.5	27.6	27.7	27.8	28.0	28.1	28.2	28.3	28.4	28.6	28.7	28.9
28	28.1	28.3	28.4	28.5	28.6	28.7	28.8	29.0	29.1	29.2	29.4	29.5	29.7	29.8	29.9
29	29.1	29.3	29.4	29.5	29.6	29.8	29.9	30.1	30.2	30.3	30.4	30.5	30.7	30.9	31.0
30	30.1	30.3	30.4	30.5	30.7	30.8	30.9	31.1	31.2	31.3	31.5	31.6	31.8	31.9	32.1
31	31.2	31.3	31.4	31.5	31.7	31.7	31.8	32.0	32.2	32.4	32.5	32.6	32.8	33.0	33.1
32	32.2	32.3	32.5	32.6	32.7	32.9	33.0	33.2	33.3	33.4	33.6	33.7	33.9	34.0	34.2
33	33.2	33.3	33.5	33.6	33.8	33.9	34.0	34.2	34.3	34.5	34.6	34.7	34.9	35.1	35.2
34	34.2	34.3	34.5	34.6	34.8	34.9	35.0	35.2	35.3	35.5	35.6	35.8	36.0	36.1	36.3
35	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	36.5	36.7	36.8	37.0	37.2	37.3

The milk to be tested for specific gravity should be well mixed, either by gently inverting the bottle several times or by pouring back and forth from the bottle to a beaker. In mixing the milk, as well as in pouring into a cylinder for the determination of the specific gravity, care should be taken to avoid the formation of air bubbles.

MILK FAT (BUTTERFAT)

In order to distribute the fat evenly the bottle of milk or cream must be well mixed, preferably by pouring back and forth from the bottle to a beaker. This should be done just before the sample for analysis is measured out. Time will be saved if the sample is taken at the time the milk is mixed before determining the specific gravity. The charge of milk consists of 17.6 cubic centimeters and is measured; the cream charge consists of 9 or 18 grams and is always weighed.

The Babcock tester must be run at a definite speed, depending upon the diameter of the centrifuge. The proper speed is usually indicated on the machine and varies from 1,000 revolutions a minute



FIG. 1.—Reading the lactometer

for 12-inch testers, to 800 revolutions for 18-inch testers. The samples should be run three times for 5, 2, and 1 minute periods, respectively. Hot water is added to bring the solution up to the neck of the bottle after the 5-minute period.

The fat column should be clear, with a yellow or light-yellow color. If the fat column contains white flakes (the result of too weak or too little acid), or black flakes (the result of too strong or too much acid), the test must be repeated. Before the reading is taken, the bottles with their columns of fat must be placed in water approximating 140° F. (60° C.), so that the fat column is surrounded by the hot water. They should remain in the bath several minutes and be read, one by one, immediately on removal. In measuring the fat

column in the milk test, read from the bottom to the extreme top of the meniscus. In measuring the fat column in the cream test, read from the bottom to the lower part of the meniscus (fig. 2). However, in the case of cream, a more accurate reading can be obtained by adding a few drops of glymol to the cream-test bottle on removal from the water bath. This eliminates the meniscus and makes reading easier.

SOLIDS NOT FAT

The solids not fat may be determined by the formula $S. N. F. = \frac{1}{4} L. + .2 F.$, in which L stands for the corrected lactometer reading and F stands for the percentage of fat.

Example: Lactometer reading at 60° F., 32; fat, 4 per cent.

$$\frac{32}{4} + (0.2 \times 4) = 8.80 \text{ solids not fat}$$

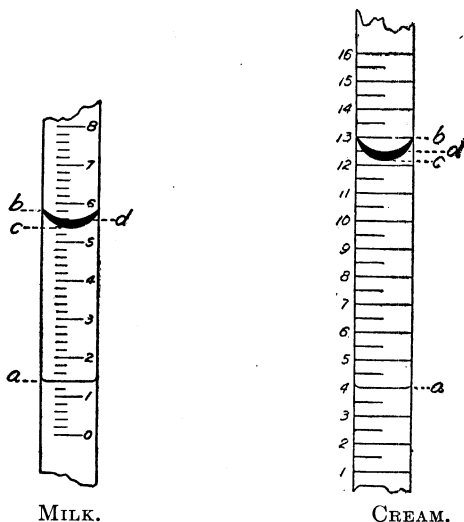


FIG. 2.—Method of reading Babcock test bottles. In reading fat column in milk testing, read from a to b, not a to c, nor a to d. In cream testing, read from a to c, not a to b, nor a to d

The following table may be used for estimating the solids not fat:

Table for determining the solids not fat in milk from a given specific gravity and per cent of fat

Per cent of fat	Lactometer reading at 60° F. (Quevenne degrees)										
	26	27	28	29	30	31	32	33	34	35	36
2.00	6.90	7.15	7.40	7.65	7.90	8.15	8.40	8.66	8.91	9.16	9.41
2.05	6.91	7.16	7.41	7.66	7.91	8.16	8.41	8.67	8.92	9.17	9.42
2.10	6.92	7.17	7.42	7.67	7.92	8.17	8.42	8.68	8.93	9.18	9.43
2.15	6.93	7.18	7.43	7.68	7.93	8.18	8.43	8.69	8.94	9.19	9.44
2.20	6.94	7.19	7.44	7.69	7.94	8.19	8.44	8.70	8.95	9.20	9.45
2.25	6.95	7.20	7.45	7.70	7.95	8.20	8.45	8.71	8.96	9.21	9.46
2.30	6.96	7.21	7.46	7.71	7.96	8.21	8.46	8.72	8.97	9.22	9.47
2.35	6.97	7.22	7.47	7.72	7.97	8.22	8.47	8.73	8.98	9.23	9.48
2.40	6.98	7.23	7.48	7.73	7.98	8.23	8.48	8.74	8.99	9.24	9.49
2.45	6.99	7.24	7.49	7.74	7.99	8.24	8.49	8.75	9.00	9.25	9.50
2.50	7.00	7.25	7.50	7.75	8.00	8.25	8.50	8.76	9.01	9.26	9.51
2.55	7.01	7.26	7.51	7.76	8.01	8.26	8.51	8.77	9.02	9.27	9.52
2.60	7.02	7.27	7.52	7.77	8.02	8.27	8.52	8.78	9.03	9.28	9.53
2.65	7.03	7.28	7.53	7.78	8.03	8.28	8.53	8.79	9.04	9.29	9.54
2.70	7.04	7.29	7.54	7.79	8.04	8.29	8.54	8.80	9.05	9.30	9.55

Table for determining the solids not fat in milk from a given specific gravity and per cent of fat—Continued

Per cent of fat	Lactometer reading at 60° F. (Quevenne degrees)										
	26	27	28	29	30	31	32	33	34	35	36
2.75	7.05	7.30	7.55	7.80	8.05	8.30	8.56	8.81	9.06	9.31	9.56
2.80	7.06	7.31	7.56	7.81	8.06	8.31	8.57	8.82	9.07	9.32	9.57
2.85	7.07	7.32	7.57	7.82	8.07	8.32	8.58	8.83	9.08	9.33	9.58
2.90	7.08	7.33	7.58	7.83	8.08	8.33	8.59	8.84	9.09	9.34	9.59
2.95	7.09	7.34	7.59	7.84	8.09	8.35	8.60	8.85	9.10	9.35	9.60
3.00	7.10	7.35	7.60	7.85	8.10	8.36	8.61	8.86	9.11	9.36	9.61
3.05	7.11	7.36	7.61	7.86	8.12	8.37	8.62	8.87	9.12	9.37	9.63
3.10	7.12	7.37	7.62	7.87	8.13	8.38	8.63	8.88	9.13	9.38	9.64
3.15	7.13	7.38	7.63	7.88	8.14	8.39	8.64	8.89	9.14	9.40	9.65
3.20	7.14	7.39	7.64	7.89	8.15	8.40	8.65	8.90	9.15	9.41	9.66
3.25	7.15	7.40	7.65	7.91	8.16	8.41	8.66	8.91	9.17	9.42	9.67
3.30	7.16	7.41	7.66	7.92	8.17	8.42	8.67	8.92	9.18	9.43	9.68
3.35	7.17	7.42	7.68	7.93	8.18	8.43	8.68	8.93	9.19	9.44	9.69
3.40	7.18	7.43	7.69	7.94	8.19	8.44	8.69	8.94	9.20	9.45	9.70
3.45	7.19	7.44	7.70	7.95	8.20	8.45	8.70	8.95	9.21	9.46	9.71
3.50	7.20	7.45	7.71	7.96	8.21	8.46	8.71	8.96	9.22	9.47	9.72
3.55	7.21	7.47	7.72	7.97	8.22	8.47	8.72	8.97	9.23	9.48	9.73
3.60	7.22	7.48	7.73	7.98	8.23	8.48	8.73	8.98	9.24	9.49	9.74
3.65	7.23	7.49	7.74	7.99	8.24	8.49	8.74	8.99	9.25	9.50	9.75
3.70	7.24	7.50	7.75	8.00	8.25	8.50	8.75	9.00	9.26	9.51	9.76
3.75	7.25	7.51	7.76	8.01	8.26	8.51	8.76	9.01	9.27	9.52	9.77
3.80	7.26	7.52	7.77	8.02	8.27	8.52	8.77	9.02	9.28	9.53	9.78
3.85	7.27	7.53	7.78	8.03	8.28	8.53	8.78	9.03	9.29	9.54	9.79
3.90	7.28	7.54	7.79	8.04	8.29	8.54	8.79	9.04	9.30	9.55	9.80
3.95	7.29	7.55	7.80	8.05	8.30	8.55	8.80	9.05	9.31	9.56	9.82
4.00	7.30	7.56	7.81	8.06	8.31	8.56	8.81	9.06	9.32	9.57	9.83
4.05	7.31	7.57	7.82	8.07	8.32	8.57	8.82	9.07	9.33	9.58	9.84
4.10	7.32	7.58	7.83	8.08	8.33	8.58	8.83	9.08	9.34	9.59	9.85
4.15	7.33	7.59	7.84	8.09	8.34	8.59	8.84	9.10	9.35	9.61	9.86
4.20	7.34	7.60	7.85	8.10	8.35	8.60	8.85	9.11	9.36	9.62	9.87
4.25	7.35	7.61	7.86	8.11	8.36	8.61	8.87	9.12	9.37	9.63	9.88
4.30	7.36	7.62	7.87	8.12	8.37	8.62	8.88	9.13	9.38	9.64	9.89
4.35	7.37	7.63	7.88	8.13	8.38	8.63	8.89	9.14	9.39	9.65	9.90
4.40	7.38	7.64	7.89	8.14	8.39	8.64	8.90	9.15	9.40	9.66	9.91
4.45	7.39	7.65	7.90	8.15	8.40	8.65	8.91	9.16	9.41	9.67	9.92
4.50	7.40	7.66	7.91	8.16	8.41	8.66	8.92	9.17	9.42	9.68	9.93
4.55	7.42	7.67	7.92	8.17	8.42	8.67	8.93	9.18	9.43	9.69	9.94
4.60	7.43	7.68	7.93	8.18	8.43	8.68	8.94	9.19	9.44	9.70	9.95
4.65	7.44	7.69	7.94	8.19	8.44	8.69	8.95	9.20	9.45	9.71	9.96
4.70	7.45	7.70	7.95	8.20	8.45	8.70	8.96	9.21	9.46	9.72	9.97
4.75	7.46	7.71	7.96	8.21	8.46	8.71	8.97	9.22	9.47	9.73	9.98
4.80	7.47	7.72	7.97	8.22	8.47	8.72	8.98	9.23	9.48	9.74	9.99
4.85	7.48	7.73	7.98	8.23	8.48	8.73	8.99	9.24	9.49	9.75	10.00
4.90	7.49	7.74	7.99	8.24	8.49	8.74	9.00	9.25	9.50	9.76	10.01
4.95	7.50	7.75	8.00	8.25	8.50	8.75	9.01	9.26	9.51	9.77	10.02
5.00	7.51	7.76	8.01	8.26	8.51	8.76	9.02	9.27	9.52	9.78	10.03
5.05	7.52	7.77	8.02	8.27	8.52	8.78	9.03	9.28	9.53	9.79	10.04
5.10	7.53	7.78	8.03	8.28	8.53	8.79	9.04	9.29	9.54	9.80	10.05
5.15	7.54	7.79	8.04	8.29	8.54	8.80	9.05	9.30	9.55	9.81	10.06
5.20	7.55	7.80	8.05	8.30	8.55	8.81	9.06	9.31	9.56	9.82	10.07
5.25	7.56	7.81	8.06	8.31	8.56	8.82	9.07	9.32	9.57	9.83	10.08
5.30	7.57	7.82	8.07	8.32	8.57	8.83	9.08	9.33	9.58	9.84	10.09
5.35	7.58	7.83	8.08	8.33	8.58	8.84	9.09	9.35	9.60	9.85	10.10
5.40	7.59	7.84	8.09	8.34	8.60	8.85	9.10	9.36	9.61	9.86	10.11
5.45	7.60	7.85	8.10	8.35	8.61	8.86	9.11	9.37	9.62	9.87	10.12
5.50	7.61	7.86	8.11	8.36	8.62	8.87	9.12	9.38	9.63	9.88	10.13
5.55	7.62	7.87	8.12	8.38	8.63	8.88	9.14	9.39	9.64	9.89	10.14
5.60	7.63	7.88	8.13	8.39	8.64	8.89	9.15	9.40	9.65	9.90	10.15
5.65	7.64	7.89	8.14	8.40	8.65	8.90	9.16	9.41	9.66	9.91	10.16
5.70	7.65	7.90	8.15	8.41	8.66	8.91	9.17	9.42	9.67	9.92	10.17
5.75	7.66	7.91	8.16	8.42	8.67	8.93	9.18	9.43	9.68	9.93	10.18
5.80	7.67	7.92	8.17	8.43	8.68	8.94	9.19	9.44	9.69	9.94	10.19
5.85	7.68	7.93	8.19	8.44	8.69	8.95	9.20	9.45	9.70	9.95	10.21
5.90	7.69	7.94	8.20	8.45	8.70	8.96	9.21	9.46	9.71	9.96	10.22
5.95	7.70	7.95	8.21	8.46	8.71	8.97	9.22	9.47	9.72	9.97	10.23

Table for determining the solids not fat in milk from a given specific gravity and per cent of fat—Continued

Per cent of fat	Lactometer reading at 60° F. (Quevenne degrees)										
	26	27	28	29	30	31	32	33	34	35	36
6.00	7.71	7.96	8.22	8.47	8.72	8.98	9.23	9.48	9.73	9.98	10.24
6.05	7.72	7.97	8.23	8.48	8.73	8.99	9.24	9.49	9.74	9.99	10.25
6.10	7.73	7.98	8.24	8.49	8.74	9.00	9.25	9.50	9.75	10.00	10.26
6.15	7.74	7.99	8.25	8.50	8.75	9.01	9.26	9.51	9.76	10.01	10.27
6.20	7.75	8.00	8.26	8.51	8.76	9.02	9.27	9.52	9.77	10.02	10.28
6.25	7.76	8.01	8.27	8.52	8.77	9.03	9.28	9.53	9.78	10.03	10.29
6.30	7.77	8.02	8.28	8.53	8.78	9.04	9.29	9.54	9.79	10.04	10.30
6.35	7.78	8.03	8.29	8.55	8.79	9.05	9.30	9.55	9.80	10.05	10.31
6.40	7.79	8.04	8.30	8.56	8.80	9.06	9.31	9.56	9.81	10.06	10.32
6.45	7.80	8.05	8.31	8.57	8.81	9.07	9.32	9.57	9.82	10.07	10.33
6.50	7.81	8.06	8.32	8.58	8.82	9.08	9.33	9.58	9.83	10.08	10.34
6.55	7.82	8.07	8.33	8.59	8.83	9.09	9.34	9.59	9.84	10.09	10.35
6.60	7.83	8.08	8.34	8.60	8.84	9.10	9.35	9.60	9.85	10.10	10.36
6.65	7.84	8.09	8.35	8.61	8.85	9.11	9.36	9.61	9.86	10.11	10.37
6.70	7.85	8.10	8.36	8.62	8.86	9.12	9.37	9.62	9.87	10.12	10.38
6.75	7.86	8.11	8.37	8.63	8.87	9.13	9.38	9.63	9.88	10.13	10.39
6.80	7.87	8.12	8.38	8.64	8.88	9.14	9.39	9.64	9.89	10.14	10.40
6.85	7.88	8.13	8.39	8.65	8.89	9.15	9.40	9.65	9.90	10.15	10.41
6.90	7.89	8.14	8.40	8.66	8.90	9.16	9.41	9.66	9.91	10.16	10.42
6.95	7.90	8.15	8.41	8.67	8.91	9.17	9.42	9.67	9.92	10.17	10.43

PROPORTIONAL PARTS

Lactometer fraction	Fraction to be added to solids not fat	Lactometer fraction	Fraction to be added to solids not fat	Lactometer fraction	Fraction to be added to solids not fat
0.1	0.03	0.4	0.10	0.7	0.18
.2	.05	.5	.13	.8	.20
.3	.08	.6	.15	.9	.23

DIRECTIONS FOR USING THE TABLE

If the specific gravity as expressed in Quevenne degrees is a whole number, the per cent of solids not fat is found at the intersection of the vertical column headed by this number, with the horizontal column corresponding to the per cent of fat. If the specific gravity as expressed in Quevenne degrees is a whole number and a decimal, the per cent of solids not fat corresponding to the whole number is first found, and to that is added the fraction found opposite the tenth under "Proportional parts." Two examples may suffice for illustration: (1) Fat, 3.8 per cent; specific gravity, 1.0320. Under column headed 32, 8.77 per cent is found corresponding to 3.8 per cent fat. (2) Fat, 3.8 per cent; specific gravity, 1.0325. The per cent of solids not fat corresponding to this per cent of fat and a specific gravity of 32 is 8.77. Under "Proportional parts" the fraction appearing opposite 0.5 is 0.13, which, added to 8.77, makes 8.90, the desired per cent.

ACIDITY

The acidity of milk or cream may be determined quickly by titrating 9 cubic centimeters against a tenth-normal sodium hydroxide solution, using phenolphthalein as indicator and reading direct. The number of cubic centimeters of hydroxide used will be the same as the acidity of the sample in hundredths of per cent. The milk must

not be diluted with water. Care must be taken to add the hydroxide to the milk only until the milk is a faint pink in color. This color disappears after a short time. The milk or cream should be kept well stirred with a glass rod during the test. By titrating in a white dish, the test may be more easily read than when a transparent container is used.

SEDIMENT

The sediment in milk may be determined by means of some form of sediment tester or by observing the bottom of the milk in the bottle. If the sediment tester (fig. 3) is used, the pint sample of milk should be warmed slightly before being run through the tester, since cold milk runs through slowly. At the completion of the test the resulting cotton disks are grouped according to the quantity of sediment shown. A perfectly clean cotton scores 10. Figure 4 shows a method of grouping with numerical rating. Though the numbers in the figure show a half-point difference only, the analyst can make

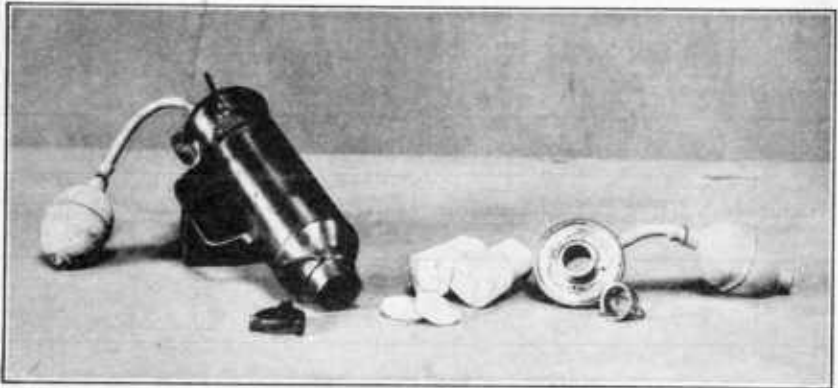


FIG. 3.—Sediment testers

ratings between these numbers. For example, a cotton disk showing less dirt than 8 but more than 8.5, can be given a rating between 8 and 8.5. Care must be taken to rinse out the tester after each sample has been run through.

It is inadvisable to use the sediment tester for cream, for on account of its heavy viscosity cream may completely clog the tester. Particles of fat may also obscure any sediment. Sediment in cream should therefore be judged in the bottle. Before scoring, the bottles should stand undisturbed for at least an hour to allow any sediment to settle. Then the bottle should be raised carefully, tipping only slightly, so that the bottom can be observed. To score "perfect," not so much as a movable speck must be visible in the bottom of the bottle. When sediment is present points must be deducted according to the quantity.

This bottle method may be used in the same manner for testing the sediment in milk, and the grading shown in Figure 4 applies equally in determining the score.

SUGGESTED SCORES ON SEDIMENT IN 1 PINT

10.....	No perceptible trace.	9.7.....	4 to 6 tiny particles.
9.9.....	1 to 2 tiny particles.	9.6.....	6 to 8 tiny particles.
9.8.....	2 to 4 tiny particles.	9.5.....	8 to 10 tiny particles.

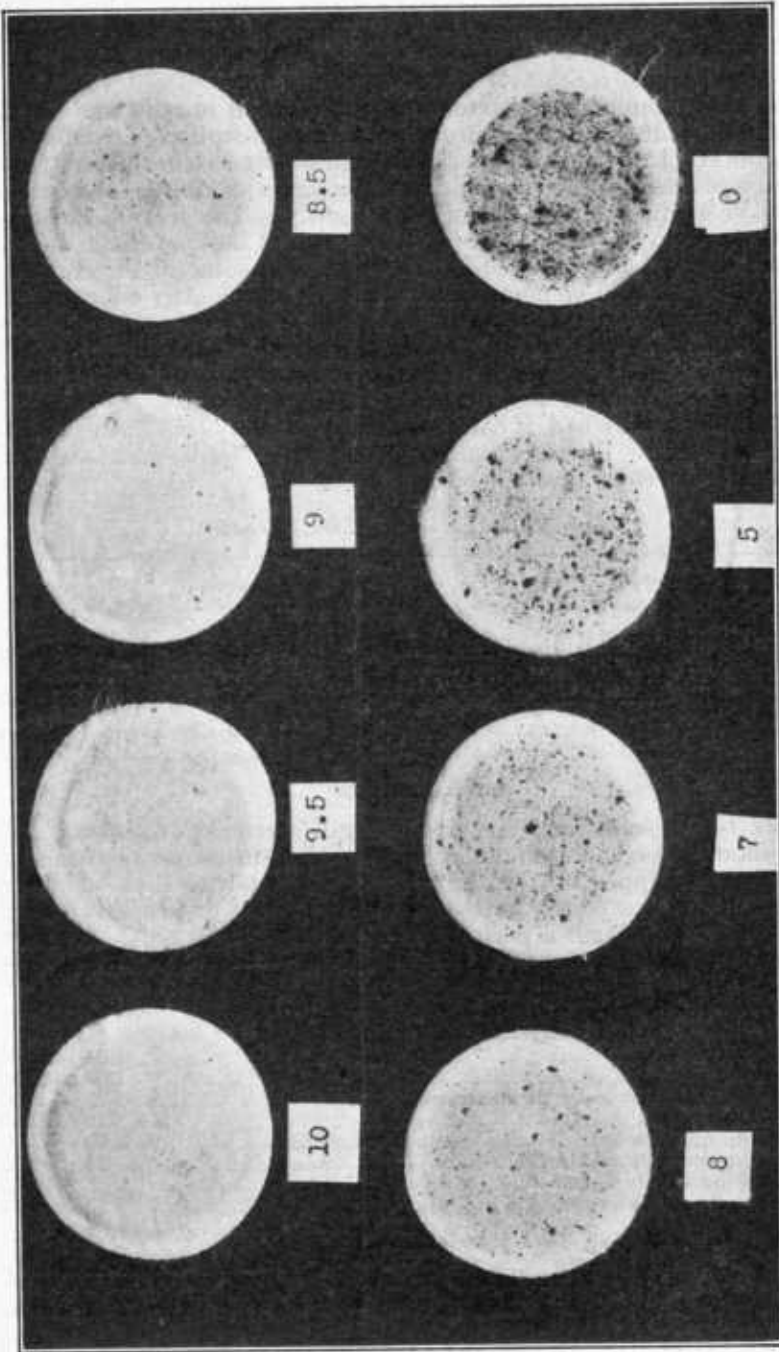


FIG. 4.—Standard disks for sediment determination (actual size). Numbers indicate the score

Further reductions are based on quantity and character of sediment. For instance, a hair would be given a 0.5 cut. When quarts are scored, the cuts would be half as severe as in the case of pints for the same quantity of sediment.

FLAVOR AND ODOR

The most common off flavors and odors found in milk and cream are those produced by certain feeds by the absorption of foul odors from the stable, by the presence of foreign substances in the milk, and by bacterial action. Before scoring the samples should be set in warm water to warm the milk and cream slightly. The scoring must be done in a room free from odors. The sample of milk or cream should be well mixed before the cap is removed, then some of the contents of the bottle should be poured into a clean beaker. Any odor present can be detected by placing the nose over the mouth of the bottle, and the flavor is judged by taking a little of the sample into the mouth. It is not advisable to swallow the liquid if many samples are to be scored, since it tends to reduce the sensitiveness of taste. If the flavor is very bad, it can usually be definitely classified. Points are deducted for flavors resulting from strong feeds, and for cowy, strong, bitter, sour, or other off flavors.

General guide for scoring flavor and odor

Flavor	Cream	Milk	Description
Excellent.....	23 and above	14 to 15.....	Supreme quality.
Good.....	21 to 23.....	13 to 14.....	Lacking special high flavor, flat, very slight feed, slightly cooked.
Fair.....	18 to 21.....	11 to 13.....	Cooked, feed, salty, slightly cowy.
Poor.....	12 to 18.....	7 to 11.....	Strong feed, weedy, bitter, strong, musty, cowy, slightly sour, metallic.
Bad.....	0 to 12.....	0 to 7.....	Rancid, strong cowy, sour, putrid, foreign.

BOTTLE AND CAP

Milk bottles only may be used in milk and cream contests, and they should be completely filled. Deductions in the score are made for dirty or chipped bottles, bottles not full, and for caps which do not cover the lips of the bottles or which do not fit properly in the cap seats. To obtain a perfect score the top of the bottle must be covered with parchment paper, metal foil, or some other cover impervious to water and dust (fig. 5).

Suggested cuts on bottle and cap

Bottle not full.....	0.25 to 1.00
Dirty bottle.....	.50 to 2.00
Cap poorly seated or leaky (if uncovered).....	.10 to 1.00
Chipped lip.....	.10 to .50
Pouring lip unprotected.....	1.00
Pouring lip partially protected.....	.25 to .75
Cap covering loosely fastened.....	.25 to .50
Cap covering nonwaterproof.....	.25 to .75

TEMPERATURE

In contests where the samples are taken on the street the temperature of the product must be recorded at the time the sample is collected; but the sample used for ascertaining temperature must not be taken for bacteria count. The inspector by previous experiments must determine how long it takes for the mercury in the tube to be-

come stationary and must leave the thermometer bulb in the liquid until the mercury has registered the correct temperature. The thermometer should be read, of course, while the bulb is in contact with the fluid. Only an accurate thermometer may be used. Should breaks in the mercury column occur, they can usually be corrected by grasping the thermometer in the hand, bulb down, and giving it a long outward sweep, or by placing the bulb in hot water until the mercury has united.

BACTERIA COUNT

In the determination of bacteria, the standard methods of bacteriological analysis of milk should be followed. Special care should be taken in the sterilization of glassware and of dilution bottles and in the preparation of media. Whenever possible, three plates should be made. In a contest with prepared samples, the following plates are recommended: Two of 1/100, and one of 1/1,000. In certain cases, such as some certified-milk contests, where the quality of the samples is exceptionally high, a dilution of 1/10 may give the most accurate counts. In a contest with street samples, it is well to vary this somewhat, as, for example, one of 1/100 and two of 1/1,000; or two of 1/1,000 and one of 1/10,000. In the latter case, however,

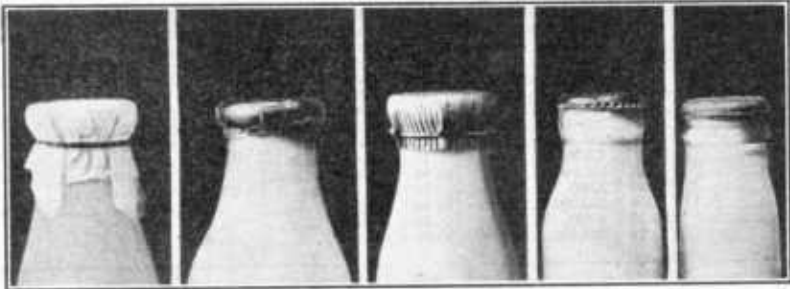


FIG. 5.—Some of the protective coverings used on milk bottles

the analyst who plates the samples regularly will know from his own experience what dilutions will be apt to give most accurate counts.

A blank containing media and dilution water should be run side by side with the regular samples. Plates must not be poured until the temperature of the melted media averages between 106 and 113° F. (41 and 45° C.). The plates must be left in the incubator for 48 hours, and the temperature of the incubator should be kept at about 100° F. (37.8° C.). For counting colonies, a counting plate and a reading glass magnifying two and one-half diameters should be used, and in reporting the counts the standard methods should be strictly followed.

In cities where the continuous contest is in operation, and where the results are averaged every 3, 6, or 12 months, there will be from 4 to 24 or more bacteria counts. It is generally conceded that the arithmetical average may give results which are too high, especially when one of the counts is much higher than the others. For this reason some other method is commonly used for determining a representative bacteria count. The following table, which is based on a parabolic curve, has been used for this purpose very generally in surprise milk contests.

Table for determining representative bacteria count

Bacteria per c. c.	Rating	Bacteria per c. c.	Rating	Bacteria per c. c.	Rating	Bacteria per c. c.	Rating
100	1.00	50,000	22.40	1,000	.10	560,000	74.82
200	1.41	1,000	.21	270,000	51.92	5,000	.33
300	1.73	60,000	24.50	1,000	.10	580,000	76.16
400	2.00	1,000	.19	280,000	52.88	5,000	.33
500	2.24	70,000	26.40	1,000	.10	600,000	77.50
600	2.45	1,000	.19	290,000	53.84	10,000	.62
700	2.65	80,000	28.30	1,000	.10	620,000	78.74
800	2.83	1,000	.17	300,000	54.80	10,000	.62
900	3.00	90,000	30.00	1,000	.08	640,000	79.98
1,000	3.16	1,000	.16	310,000	55.84	10,000	.62
100	.13	100,000	31.60	1,000	.08	660,000	81.22
2,000	4.47	1,000	.13	320,000	56.48	10,000	.62
100	.10	110,000	32.91	1,000	.08	680,000	82.46
3,000	5.48	1,000	.13	330,000	57.32	10,000	.62
100	.08	120,000	34.22	1,000	.08	700,000	83.70
4,000	6.32	1,000	.13	340,000	58.16	10,000	.58
100	.08	130,000	35.53	1,000	.08	750,000	86.60
5,000	7.08	1,000	.13	350,000	59.00	10,000	.58
100	.07	140,000	36.84	1,000	.08	800,000	89.50
6,000	7.75	1,000	.13	360,000	59.84	10,000	.55
100	.06	150,000	38.15	1,000	.08	850,000	92.55
7,000	8.37	1,000	.13	370,000	60.68	10,000	.55
100	.06	160,000	39.46	1,000	.08	900,000	95.00
8,000	8.95	1,000	.13	380,000	61.52	10,000	.50
100	.05	170,000	40.77	1,000	.08	950,000	97.50
9,000	9.50	1,000	.13	390,000	62.36	10,000	.50
100	.05	180,000	42.08	1,000	.08	1,000,000	100.00
10,000	10.00	1,000	.13	400,000	63.20	100,000	4.10
1,000	.46	190,000	43.39	5,000	.38	2,000,000	141.00
15,000	12.30	1,000	.13	420,000	64.72	100,000	3.10
1,000	.36	200,000	44.70	5,000	.38	3,000,000	173.00
20,000	14.10	1,000	.11	440,000	66.24	100,000	2.70
1,000	.34	210,000	45.76	5,000	.38	4,000,000	200.00
25,000	15.80	1,000	.11	460,000	67.76	100,000	2.40
1,000	.30	220,000	46.82	5,000	.38	5,000,000	224.00
30,000	17.30	1,000	.11	480,000	69.28	100,000	2.10
1,000	.28	230,000	47.88	5,000	.38	6,000,000	245.00
35,000	18.70	1,000	.11	500,000	70.80	100,000	2.00
1,000	.26	240,000	48.94	5,000	.33	7,000,000	265.00
40,000	20.00	1,000	.11	520,000	72.14	8,000,000	283.00
1,000	.24	250,000	50.00	5,000	.33	9,000,000	300.00
45,000	21.20	1,000	.10	540,000	73.48		
1,000	.24	260,000	50.96	5,000	.33		

Given several bacteria counts from a dairy, a representative count is determined from the table in this manner. Suppose there are five counts, 8,500, 4,200, 40,000, 400,000, and 17,000. The ratings for these numbers are then taken from the table, added, and the sum obtained divided by the number of counts.

Bacteria counts:	Ratings
8,500	9.20
4,200	6.48
40,000	20.00
400,000	63.20
17,000	13.02

$$\begin{array}{r} 5)111.90 \\ \underline{22.38} = 50,000 \end{array}$$

It will be found by referring to the table that the average of the ratings, 22.38, is equal to approximately 50,000, which would be taken as the representative bacteria count. The arithmetical average of these same five counts would be almost twice as high, or approximately 94,000.

Another method of determining the bacteria rating is by finding the statistical average known as the median. This should be used, however, only when there are a considerable number of samples (at least 20) in each case. It is easily found by alternately striking off the highest and lowest counts until only one or two remain. For example, take five bacteria counts (which, however, would not be enough to give accurate results) as follows: 9,000, 20,000, 50,000, 90,000, and 400,000. By striking off the two higher counts and the two lower counts 50,000 would remain as the median and would be taken as the bacterial average. The arithmetical average of these counts, due to the influence of one which is exceptionally high, would be 113,800, or more than double the median.

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UNITED STATES DEPARTMENT OF AGRICULTURE**

April 24, 1926

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