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KANSAS STATE AGRICULTURAL COLLEGE

STATE DAIRY COMMISSIONER'S BULLETIN No. 4

REVISED EDITION OF No. 3

THE PERMIT SYSTEM OF CREAM-BUYING

Information for Persons About to Engage in Sampling
and Testing Cream in Kansas

This bulletin supersedes all previous instructions and publications.



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FOREWORD

The need of the cream receiving station is evident to those who are acquainted with dairy conditions in Kansas. A large number of farmers have very little cream. Yet by means of the cream receiving station they are furnished with a home market, thus making the future of the dairy industry more certain.

The purpose of this bulletin is to place before those who are interested in this work an efficient guide for the better handling of cream. It has been especially prepared for persons who are about to engage in the receiving, sampling, grading, and testing of cream.

The principles of the Kansas dairy law are embodied herein. It is hoped that those concerned will not disregard the spirit of the law, but will cooperate with this department, thus increasing the scope of work which can be accomplished.

F. D. FARRELL
Director

THE PERMIT SYSTEM OF CREAM-BUYING

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CREAM STATION EQUIPMENT

The success of the cream station operator depends on his business methods, his personality, the way he advertises his business, the condition in which he keeps his cream station, and his equipment.

Location of Station.—A separate building situated on a well-drained piece of ground, at least 60 feet from any contaminating surroundings, is the best location. Some rooms are located at the corner of produce buildings and can be made to conform with the law by building a vestibule on the door, having two doors, and keeping both closed at all times. (Fig. 1.)

Size of Station.—The following table gives the approximate size of a cream station necessary for the successful handling of the stated amount of business :

<i>Capacity</i>	<i>Size of floor space</i>
24 cans per week or less.....	10 by 14 ft. or larger
25 to 60 cans per week.....	14 by 16 ft. or larger
61 to 75 cans per week.....	16 by 20 ft. or larger
76 or more cans per week.....	20 by 24 ft. or larger

The tendency in the past has been to make cream stations too small rather than too large, thus impeding the growth of the business. There should always be room for all the empty cans inside the station. A cramped space handicaps the operator in his work and, especially on busy days, reduces the rapidity with which he can handle the cream received.

Walls and Ceiling.—Whatever the construction of the building, the interior should be clean, smooth, and well painted, preferably in a light color. Decorations should be few and well chosen. The buyer's permit (see page 39) must occupy a

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conspicuous place. The window surface should be at least one-fifth as large as the area of the floor. The walls and ceiling should not be papered. Due to the steam, especially in the winter time, the paper soon becomes torn, and presents an untidy appearance, as well as being a harbor for dirt and insects.

Floor.—A smooth, well-finished cement floor, sloping to a drain, is the most suitable material for underfoot in a cream station. A tight wood floor of well-matched lumber is also satisfactory if kept clean and well-painted. (Fig. 2.) It is not

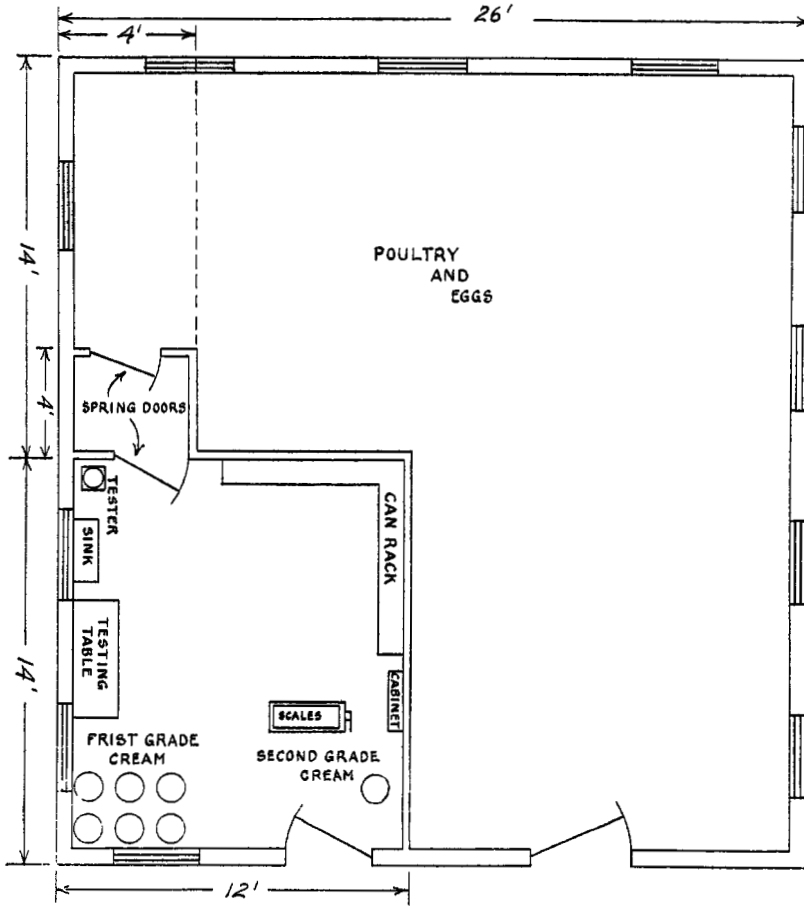


FIG. 1.—Floor plan of a cream station connected with a produce room. This arrangement conforms to the law

advisable to oil the floor, because when mud is tracked in, it mixes with the oil and makes the floor hard to clean.

Outside Conveniences.—A covered porch over the principal door affords a very desirable protection against wind, rain, and sun. Well-fitted screens should be provided for windows and doors. A load of crushed stone or gravel spread in front of the cream station will greatly reduce the amount of dirt carried into the station. Some efficient system of drainage by which waste water can be quickly disposed of should be provided. In the absence of a better system, a 50-foot line of drain tile, laid 4 feet in the ground and opening into a ditch or gully, is recommended.

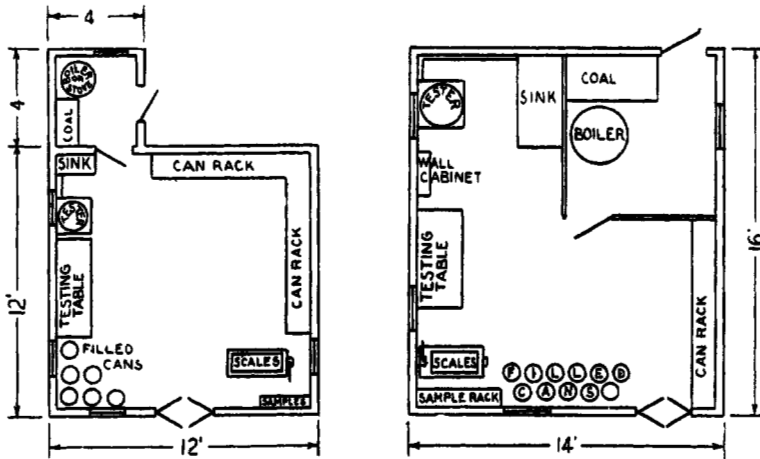


FIG. 2.—Floor plans of well-arranged and well-equipped cream stations

The equipment of a modern cream station consists primarily of the following :

Can Rack.—For the purpose of inverting empty cans in pure air as required by law, a can rack is necessary. Such a rack should be large enough to receive all empty cans which are likely to be onhand at any time. A very convenient rack may be constructed of substantial uprights, to which are nailed four-by-one crosspieces, as illustrated in figure 3. The crosspieces on which the mouths of the cans rest are about 12 inches from the wall, and the lowest one should be not less than 8 inches from the floor. The upright and cross-pieces should be made of dressed lumber. Upon completion, the addition of

a coat of paint will improve the appearance of the rack, and the painted surface can easily be kept clean. Eight-penny nails may be driven just above each can to receive the lids. A more sanitary, though somewhat more expensive, rack may be provided by substituting 1¼-inch galvanized iron piping for the wooden crosspieces. The piping collects less dust than the wood and is more easily cleaned.

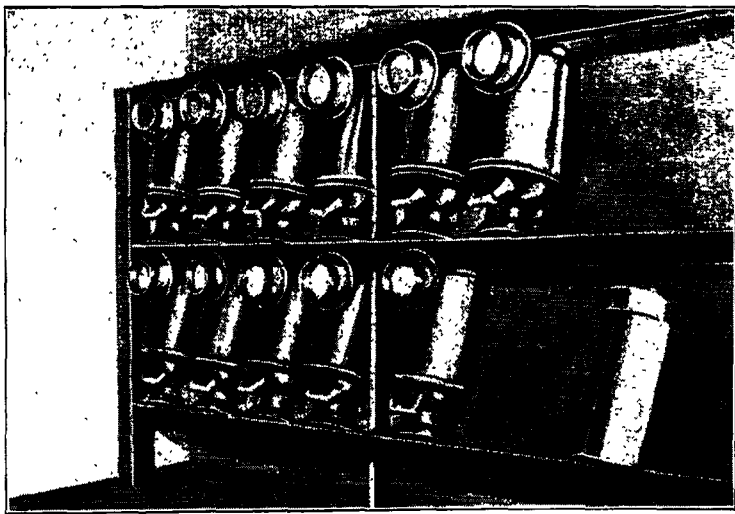


FIG. 3.—An inexpensive, but well-made can rack

Boiler and Steam Fittings.—A steam boiler provided with the proper connections and fittings is the best source of steam and hot water for washing cans, sample jars, and apparatus. To prevent excessive heating of the station during the summer months, the boiler should be partitioned off from the room in which cream is received. By firing the boiler in the morning and allowing the fire to go out soon after testing, enough hot water will be provided for the entire day.

Sanitary Sink.—A cream station should contain a sink in which cans and glassware may be conveniently washed. The half-round galvanized steel sink, large enough to receive a 10-gallon can, as shown in figure 4, is very suitable. The two-compartment sink is recommended, since it enables the operator to have wash water in one compartment and rinse water in the other, thus greatly facilitating the washing of utensils. A

waste pipe, emptying into a drain, should be provided for the removal of waste water. The practice of allowing wash water to stand in the sink or in an open bucket under the sink is insanitary. Dirty water allowed to stand over night becomes offensive and will contaminate the cream. The sink should be washed every day.

Babcock Tester.—The Babcock tester, in which the bottles

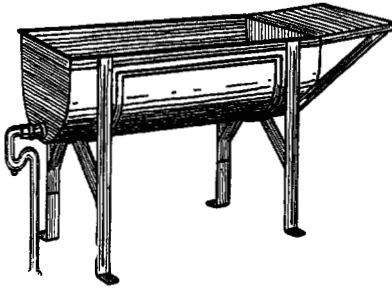


FIG. 4.—Sink with sanitary drain

are whirled, is made in various styles, any of which are satisfactory if they are: (1) So covered as to protect the operator from acid and broken glass in case of accident; (2) firmly mounted on a rigid level support; (3) of sufficient size to handle readily an average day's business. A 24-bottle tester is large enough for any

cream station and a 12-bottle tester is sufficient for the average.

Weigh Scales.—Scales for station use should be accurate and sensitive to a quarter of a pound.

Cream Sampler.—The stirring-rod and cream sampler illustrated in figure 5 is superior to the ordinary stirring-rod, which has a round bottom and generally fails to move the cream at the bottom of the can. Any tinner can make it by soldering a strip of heavy tin to the bottom of the ordinary stirring-rod and making the holes as illustrated. The tin should be attached not less than one-half inch from the rim of the sampler in order not to interfere with the filling of the sample jars.

The Proper Care of the Stirring-rod.—After the rod has been used the first time most of the cream should be drained off, the rest rinsed off with a small amount of water. The stirring-rod should then be placed in a clean empty cream can and the cover placed on the can loosely to keep out flies. This process should be repeated every time the rod is used. At the end of the day's work the stirring-rod should be washed, scalded, and hung in a clean place and allowed to dry. The rod should not be wiped dry; neither should it be left in the cream.

Sample Jars.—Any clean, wide-mouthed bottle holding enough cream for two samples is suitable for receiving cream samples. It should be provided with a tightly fitting screw-cap or cover to prevent evaporation of moisture, and this cover should have a number stamped thereon. A cream station should have enough sample jars to hold all samples 24 hours after testing.

Cream Scales.—All cream samples for testing must be accurately weighed on sensitive scales, as required by ruling 14, which reads as follows

Rule 14.—The use of the pipette for measuring the amount of cream used in testing is not approved because thin cream is heavier than rich cream. Thus a pipette full of thin cream would weigh more than a pipette full of rich cream. Also some cream is yeasty and foamy and has air bubbles in it and it would be impossible to measure out exactly 9 or 18 grams. Persons testing cream shall weigh the samples accurately on a scale to be approved by the dairy commissioner. The weight of cream shall conform to the style of test bottle and shall be exactly 9 or 18 grams. This ruling has been in force since July 1, 1912.

Paying for Cream the Day It Is Received.—Customers may receive payment for deliveries of cream only upon completion of the Babcock test, as is set forth in rule 16, which reads as follows:

Rule 16.—No person or persons, firm or corporation purchasing milk or cream by the Babcock test shall pay for the milk or cream so purchased until the Babcock test has been fully and accurately made in accordance with the provision of section 5 of chapter 237 of the Laws of Kansas, and in accordance with the instructions for drawing samples and conducting the test issued by the dairy commissioner. In no case shall any part of the sampling or testing as prescribed by the dairy commissioner be omitted or be carelessly or hastily performed.

The scales should be protected from moisture, dirt, and flies by a box or oilcloth cover placed over them when not in use. As provided in section 5 of the dairy law, a dirty scale is considered inaccurate and its use is illegal. Any clean scale which is sensitive to one drop of cream and to at least one-tenth of a gram is approved for cream-testing purposes.

It is not advisable to test and pay for cream the same day it is received, because the operator is often so busy he is likely to omit part of the sampling and testing, thus making an inaccurate test.

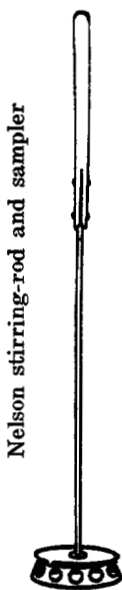


FIG. 5.

Acid.—Sulphuric acid, when not in use, should be kept tightly corked, as it absorbs moisture from the air and may thus become too weak for use.

Pipette.—A pipette is convenient for many purposes, but must not be used for measuring the charge of cream for testing. One with a rather large mouth is preferred, as it will become clogged less readily.

Test Bottles.—A cream station should be equipped with about twice as many bottles as are necessary to fill the tester. Bottles are most easily washed just after they have been used. Use a slender brush with a tuft of bristles on the end. The 9-gram, 50 percent, 6-inch bottle, graduated to one-half percent, is recommended for station use. The 9-gram and 18-gram, 50 percent, 9-inch cream bottles also meet with official approval. The 18-gram, 6-inch bottle is not approved.

Acid Measure.—The acid measure is a small glass cylinder generally marked at 8.8 c. c. and 17.6 c. c. for measuring the amount of acid used in testing.

Waterbath.—The waterbath illustrated in figure 6 gives excellent satisfaction as a means of holding tests at 135° for 10 minutes, as required by law. A metal carrier receives the bottles and holds them upright when in the bath water. The bath must be deep enough so that the water will come above the fat column in the neck of the bottle. Station equipment should always include an accurate thermometer.

Dividers.—Dividers should be sharp-pointed and move with plenty of friction at the hinge. Dividers which are likely to slip should be either repaired or discarded.

Washing Powder.—Use a mineral washing powder. Soaps containing animal or vegetable fats, or washing powders which produce suds, are not suitable for cream-station work.

Soft Water.—Water containing minerals, especially lime, is unsuitable for testing and is inefficient for washing glass-ware. When acid is added to well or spring water, the minerals are acted upon, often with the production of gas and the precipitation of insoluble compounds. The latter frequently cause spotted or cloudy tests. Use clean rain water or melted ice. If such forms of soft water are not available, boil the hard water and let stand for 24 hours.

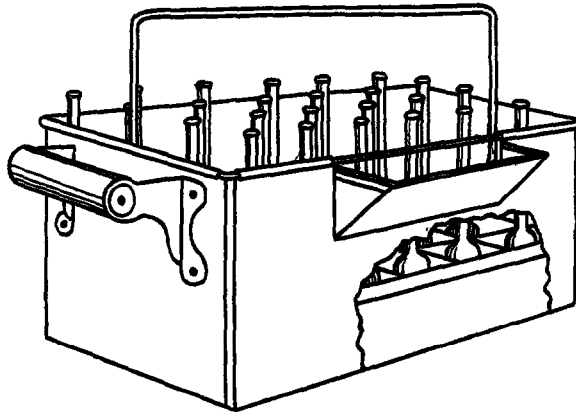


FIG. 6.—Waterbath



Brush for washing test bottles

FIG. 8.

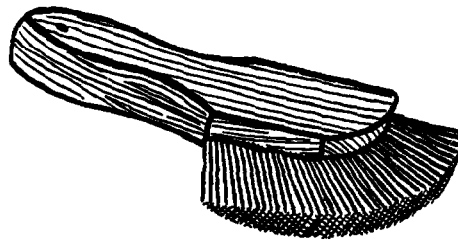


FIG. 7.—Brush for washing cans

Sanitary Accessories.—Supply of hot water; scrubbing-brush and pail; dustcloth; brushes for cleaning cans and glassware (figs. 7 and 8); and clean towels and washcloths. It is advisable to clean a cream station at the end of each day, for when the dirt is allowed to accumulate it is often neglected.

CREAM STATION CONVENIENCES

Double screen doors swinging both ways are of great convenience in permitting the operator carrying a can of cream to push open the door without setting the can of cream down. A particular advantage lies in the fact that the doors are open just long enough to allow the operator to pass through, thus aiding in the control of the fly pest. (Fig. 9.)

When the checks are written it saves delay to have them placed alphabetically in a small bill file. (Fig. 10.)

It is often hard to read the graduations on the test bottles. By rubbing a piece of chalk over them the divisions and figures will show up very distinctly and make the reading easier.

Due to the vibration when the tester is running, it is impossible to weigh out samples if the test scales are placed on the same table with the tester. By cutting a hole in the floor and driving a 3-inch pipe several feet into the ground and then mounting the cream scales on a platform firmly attached to the top of the pipe the operator is able to overcome this difficulty. (Fig. 11.)

When the lid is left on a can of cream for some time a very disagreeable odor often develops. This can be eliminated by taking a small hoop or square frame and tacking a piece of screen and cheesecloth over it and placing this over the can containing cream. This permits a circulation of air and at the same time keeps out dirt and insects.

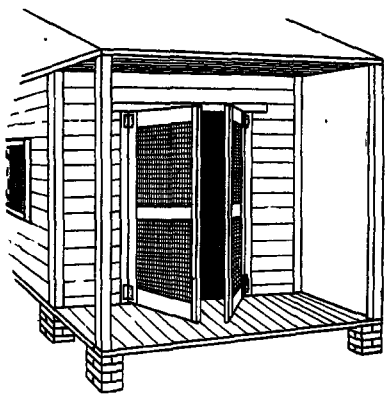


FIG. 9.—Double swinging doors

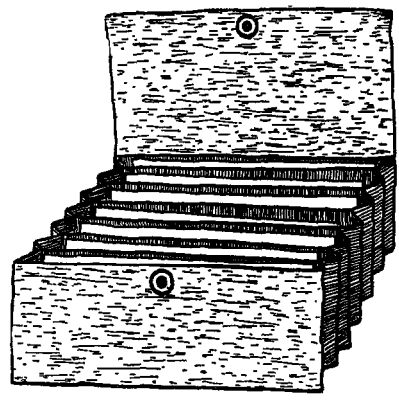


FIG. 10.—Check file

It is advisable to have a platform between the station and the street for the loading and unloading of cans. (Fig. 12.)

The surroundings of the cream station should be kept neat and clean. The inside should likewise be kept neat and clean. It is well to have a box or cabinet in which to store utensils and supplies as shown in figure 13.

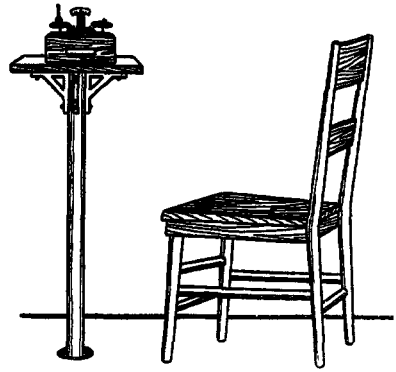


FIG. 11.—Vibration-proof test table

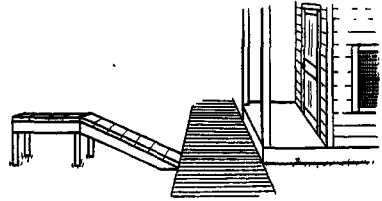


FIG. 12.—Cream-loading platform

Either of the cups illustrated in figure 14 is very convenient in adding water to the test bottles.

The acid waste can be taken care of by means of the refuse jar over which a draining board is placed and in which the bottles are inverted as illustrated in figure 15.

Occasionally the operator has only a few tests to make. The waterbath as illustrated in figure 16 may be used. It can be

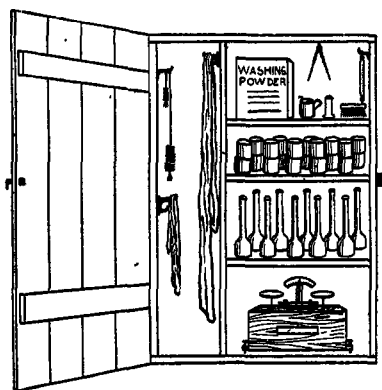


FIG. 13.—Wall cabinet for apparatus and supplies

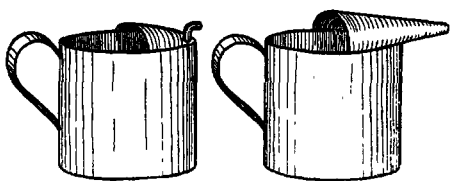


FIG. 14.—Convenient cups for adding hot water to test bottles

made as follows: Make a heavy tin cylinder, 6 inches or more in height, according to the size of the test bottles, and 4 inches in diameter. Half an inch from the top, punch a quarter-inch hole to prevent the water from flooding the tests. Fill the bath with water at 140° F. up to the hole and place the test bottles in the water for 10 minutes.

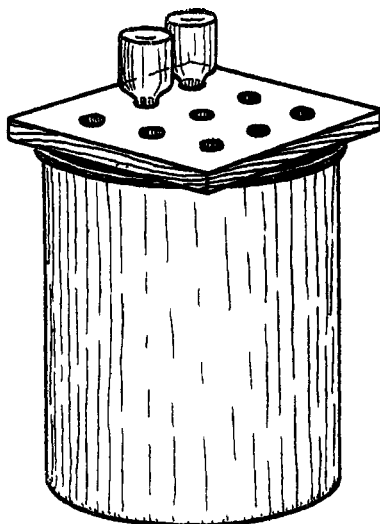


FIG. 15.—Draining board and re-
 use jar

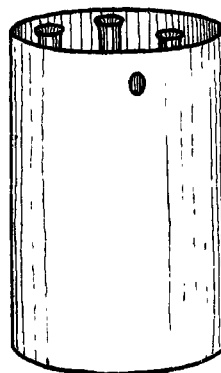


FIG. 16.—Simple
 waterbath

OFFICIAL INSTRUCTIONS FOR RECEIVING AND SAMPLING CREAM

RECEIVING CREAM

Success in receiving and in testing cream calls for systematic methods and a businesslike attitude toward patrons. When a can of cream is received:

1. Write the patron's name plainly on the receiving sheet.
2. Balance the weigh scales.
3. Weigh the cream carefully.
4. Record the gross weight of cream and can.
5. Note the appearance of, taste, and grade all cream.
6. Sample, as hereafter described.
7. Place the number of the sample jar opposite the patron's name.

8. Rinse the empty can with about a pint of hot water.
9. Place the patron's can in the sink and wash it thoroughly. After draining it well, place the can on the scales and weigh it.
10. Subtract the weight of the can from the gross weight of the can and cream and enter the remainder on the receiving sheet as the weight of cream to be paid for.
11. Return the can to the patron, at the same time handing him a check for the previous delivery and stating the amount of cream just received and the price being paid for butterfat.

SAMPLING CREAM

Persons desiring to sample only will be given an examination dealing particularly with this subject. However, such persons will be expected to have a general knowledge of the entire process of receiving, sampling, and testing cream.

Sampling is the foundation of the test, and no tester, however skillful, can arrive at the proper test of a delivery of cream if the sample was improperly taken. Neither can sampling be done to the best advantage if the sampler does not understand the operations that are to follow. The authors recommend that the testing be done by the person who takes the samples.

How to Mix the Cream.—The purpose of thoroughly mixing the cream is to cause the sample taken to represent truly the richness of the cream. The average amount of cream delivered at stations by Kansas dairymen is slightly more than 20 pounds. One pound is equivalent to 456.6 grams, and 20 pounds will therefore weigh 9132 grams. If a 9-gram sample is used for testing, the sample is less than one one-thousandth of the entire amount; if an 18-gram sample is taken, it is less than one five-hundredth. In any case, the sample is so small that if it has been inaccurately taken the error will be multiplied many times when payment is made for the cream. The importance of thoroughly mixing the cream is evident from the following simple comparison:

We will presume that you have a barrel of water containing ten thousand small green peas whose tendency is to come to the top, just as fat globules in cream rise to the surface. This barrel and its contents have been undisturbed for 24 hours. You have a tin cup with a long handle. The tin cup will contain one one-thousandth as much water as the barrel contains.

To secure an accurate sample of the peas in the water, you must, under the circumstances, get just 10 peas, or one one-thousandth of the total number, every time you take a sample. If more or fewer peas than exactly 10 are found in the cup, the sample is obviously inaccurate. The first step will be to mix thoroughly the contents of the barrel so that there will be just as many peas in the central and lower parts as there are at the top where they have risen. The quickest and best method of mixing is to pour the contents of the barrel from one receptacle to another several times and take the sample before the peas have had time to rise to the surface. The stirring-rod could be used for the mixing process, but would require a much longer time to secure a uniform mixture and obtain an accurate result.

This simple example shows the principle involved in getting an accurate sample of cream for testing. The pouring or mixing must be thoroughly done both just before transferring the sample from the cream into the sample jar and also before putting the required amount of the final sample into the test bottle. If cream is very thick or is frozen, the foregoing comparison emphasizes the importance of heating the cream until it is in a fluid condition.

How to Take the Sample.—To secure an accurate and lawful sample of cream, which has previously been graded, pour the cream from one can to another at least three times, and stir thoroughly, using both an up-and-down and a side-to-side movement. Then take, from as near the middle of the cream as possible, enough cream to make at least two tests. "The middle" refers to a point halfway from the bottom of the can to the top of the cream. Transfer the sample to a clean, dry sample jar, and if it is not to be tested immediately put the lid on tight and place in a cool, clean place. Place the number stamped in the cover of the sample jar before the name of the patron on the receiving sheet, thus keeping an accurate record of each delivery of cream.

Always mix by pouring, unless the McKay or a similar sampler is used. If the cream is thick or doughy, churned or frozen, place the can containing the cream in hot water and warm it to 110° F., stirring and pouring frequently during the heating. When the cream is smooth remove it from the hot water and sample it in the usual manner. A large wash boiler or tub half full of water, kept hot by an oil stove may be used.

OFFICIAL INSTRUCTIONS FOR TESTING AND PAYING FOR CREAM

TESTING CREAM

WHEN TO TEST

Testing should be done at the time when the operator is least likely to be disturbed. The period required is at least one hour for an ordinary day's business. The hours commonly employed are from 8 to 9 o'clock a. m. and 4 :30 to 5 :30 p. m. The afternoon hours are recommended to operators using hand testers, as the day's work can be completed and the checks written in the evening or early the next morning. Operators using steam testers will find morning testing advisable, as they will have plenty of steam or hot water from the boiler during the day. Samples may be left for 48 hours, provided they are tightly covered and kept in a cool place, but daily testing is advised whenever eight or more samples are at hand.

PROPER METHOD OF MAKING A TEST

(1)

When ready for testing, place in warm water the sample jars containing the cream and heat the water until the cream reaches a temperature of 110° F.

The heat causes the cream to become fluid, and the fat globules can then be more thoroughly mixed. Do not allow the temperature to exceed 110°, or the fat will become liquefied and rise to the top, making accurate sampling difficult.

(2)

Pour the sample back and forth from one jar to another until the cream is uniform in color and smooth in physical condition, Cream containing lumps or yellow streaks is incompletely mixed.

(3)

See that the balance used for weighing the cream is clean, level, and protected from air currents.

After carefully leveling the scale and balancing the bottle (or bottles), weigh out the required amount of cream, 9 or 18 grams, using a pipette to transfer the cream from the sample

jar to the test bottle. If too much cream should be added, shake bottle thoroughly and remove the excess with a clean wire or slender glass rod. Mark each test bottle plainly with the same number given the corresponding sample jar.

To lengthen the life of the scales, always use the arrest rod to bring the pointer back to the center before you add or take cream or weights from either scale pan.

(4)

Do not empty the sample jars until all of the tests have been made and the tests recorded. Occasionally a bottle may break or a test be so cloudy that it cannot be read and a second test will be necessary.

(5)

When the required amount of cream has been weighed out in each bottle, place the bottles in a waterbath at 68° F. or colder, and allow them to remain immersed therein for at least 10 minutes, until the cream is at a temperature of 68° F. Unless the cream is cooled, the action of the acid may be too rapid and the tests may be burnt or cloudy.

Add to each bottle the proper measure of acid. This will be 8 c. c. for 9 grams of cream, a low-testing cream requiring the most acid. The acid should be at a temperature of 68°. While adding the acid, hold the bottle at an angle, at the same time revolving the bottle so that the acid will wash down all the cream which adheres to the inside of the neck.

Mix the contents with a gentle rotary motion until all of the curd has been dissolved and the sample is of a dark chocolate color. The darker the color of the mixture, the darker will be the color of the butterfat in the test, and *vice versa*.

REASONS FOR ADDING SULPHURIC ACID

Sulphuric acid dissolves all solids other than fat, among which are the casein, albumin, milk sugar, and ash, of the milk and cream. This liberates the fat and increases the rapidity and ease with which the butterfat can be separated from the remainder of the solution.

Sulphuric acid increases the specific gravity of the milk or cream mixture, which causes the liberated fat globules to rise into the neck of the test bottle more rapidly than would be the case in a less dense liquid.

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Sulphuric acid liquefies the fat due to the development of heat given off; the acid and substance to be tested combine.

(6)

Fill the bottles to the bottom of the neck with hot soft water (180° F.) and place them in the centrifuge (Babcock tester). The bottles should be so arranged that the tester is balanced. Whirl the tester for five minutes. This period means the time during which the tester is running at full speed and does not include the time used in starting or stopping it. Caution! Leave the lid of tester down until it stops running. A tester 14 inches in diameter requires a speed of about 900 revolutions a minute and one 20 inches in diameter about 750 revolutions.

Stop the tester and add enough water (180° F.) to bring the fat up to the graduated neck. Unless a steam tester is used, place the bottles in a hot water bath (180° F.) until the fat is liquefied, which process will require about five minutes.

Whirl the tester for two minutes more. After the second run, take the bottles out of the tester and place them in a waterbath of 140° F. for 10 minutes. The temperature of the water must not be allowed to go below 135° F. The water should be deep enough to surround the fat in the necks of all the bottles. The careful use of the waterbath will contribute greatly in cutting down shortage caused by overreading of tests.

(7)

Before reading a test; first observe the color. It should be a golden yellow, free from specks. Do not attempt to read any tests which contain dark, cloudy, foreign matter or pieces of curd, especially when they cause the lower line of the butterfat to be irregular. Retest all such samples.

Each operator is required to use glymol, which is a white mineral oil lighter than butterfat, sometimes colored red by the use of alkanet root. The purpose of glymol is to remove the meniscus or curved portion from the top of the butterfat column, thus making a separate line which enables the tester to read the test more accurately. Glymol may be added just before reading the test. (Fig. 17.) It is advisable to have it warm, Add three or four drops of glymol, letting it run down the side of the neck of the bottle (do not let it drop direct on the butterfat column), hold the bottle perpendicular and on a

level with the eye. Place one arm of the dividers at the lower end of the fat column and raise the other arm at the top to the dividing line between the butterfat and the glymol.

Hold the arms of the dividers rigid and move the lower arm down until the point is at the zero mark of the test bottle.

The upper arm will point to the line indicating the percent of

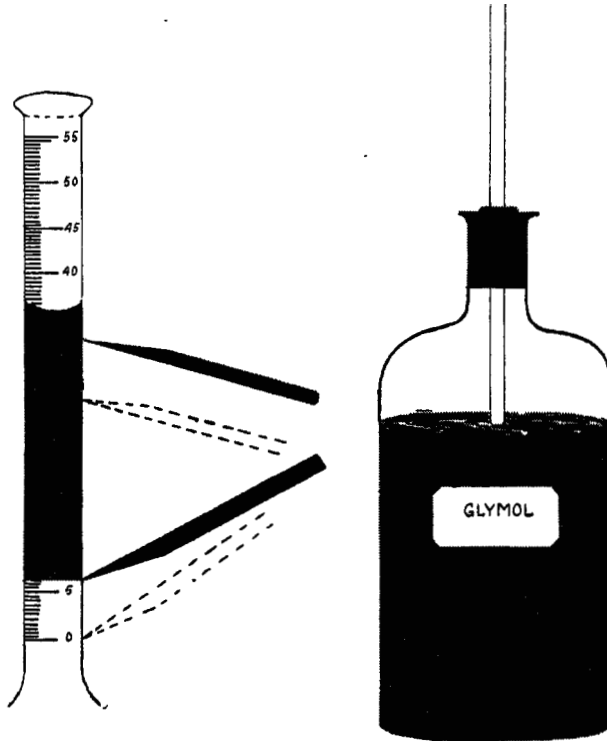


FIG. 17.—Method of reading the cream test when glymol is used

fat. Enter the test on the receiving sheet in the space provided. Be sure that the number of the test bottle agrees with the patron's number. Empty the contents of the test bottle into a slop jar.

Unless it contains preservatives or is in bad condition, do not throw away cream left in sample jars when testing is done, but hold for 24 hours and add to the next shipment. Cut down waste of cream and running expenses wherever possible.

WASHING GLASSWARE

As soon as you have finished testing, wash all dirty bottles, sample jars, pipettes, and brushes in hot soft water containing a mineral washing powder. Test bottles can generally be perfectly cleaned by filling each half full, inverting it, holding the thumb over its mouth and shaking the bottle vigorously. Use a slender brush if necessary. Do not mix washing powder and strong acid in a test bottle, but weak acid and washing powder will often remove sediment which water will not dissolve.

Do not use soap for washing test bottles. Fat may cling to the inside of the bottle and cause the next test to be inaccurate.

Sample jars and test bottles should be inverted and allowed to drain until dry. If glassware does not drain clean, too much washing powder has been used. Scald all metal utensils.

PAYING FOR CREAM

In determining the amount of butterfat in a delivery of cream, multiply the pounds of cream by the test and point off two decimal places. This will give the number of pounds of butterfat. To find the amount of check due patron, multiply pounds of butterfat by the price per pound paid for butterfat.

WHAT TO DO WITH HALF POUNDS AND HALF PERCENTS

For commercial purposes it is unnecessary to deal with fractions of pounds and percents when making a record of delivery and tests of cream. The weight of the cream will seldom be exactly on the half-pound, and the most satisfactory method is to credit the patron with the nearest number of entire pounds. If the net weight of the cream be $21\frac{3}{4}$ pounds, credit the patron with 22 pounds. If the cream should weigh $21\frac{1}{4}$ pounds, the figure recorded should be 21.

Follow the same plan in making a record of the tests. In case either the test or the weight should be exactly on the one-half mark, credit the creamery with the one-half percent of test and the farmer with the one-half pound. If one follows such a plan, the check paid the farmer will, in the vast majority of cases, be absolutely equitable for all practical purposes. In determining the percent of fat in a composite sample the operator should not drop the half percents.

TESTING OTHER DAIRY PRODUCTS

TESTING MILK

The Babcock test for milk is made in a manner similar to that used for cream, but the following changes should be noted:

Secure a milk test bottle graduated to 8 percent. Do not attempt to test milk in a cream bottle. The milk may either be weighed out to exactly 18 grams, or be measured out with a 17.6 c. c. pipette, which also holds exactly 18 grams of milk. Either method is accurate. Add about 17.6 c. c. of acid. Do not add water as in the case of cream, but first whirl (in the tester) the mixture of milk and acid for five minutes; take out and immerse in a 180° F. bath for five minutes, then add water to the bottom of the neck of the bottle, whirl for two minutes and then add enough water to bring the fat well into the neck of the bottle and whirl for one minute more. Place the bottle in the waterbath (120° F.) for 10 minutes. The test should be read from the bottom of the fat column to the extreme top of the meniscus. (Fig. 18.)

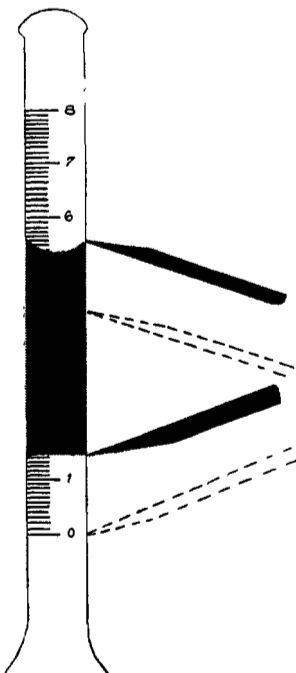


FIG. 18.—Method of reading the milk test

TESTING SKIMMILK

Skimmilk is tested in about the same manner as whole milk, with the following slight changes:

About 20 c. c. of acid instead of 17.5 should be used. A special skimmilk bottle should be secured in which the test may be read to one one-hundredth of 1 percent. The tester should be kept as hot as possible during the time that the bottle is being whirled. Since the fat globules in skimmilk are very small and are not completely brought to the surface with the ordinary speed, the speed of the tester should be increased at least 10 percent. Samples of skimmilk which contain less than one one-hundredth of 1 percent butterfat are exceed-

ingly rare, and in case the test fails to reveal the presence of any butterfat, the probability that the testing was poorly done is very much greater than that the skimmilk contained no butterfat.

TESTING ICE CREAM

Several methods are used at present in testing ice cream. The most successful method used in recent years in the laboratories of the Kansas State Agricultural College is that developed by C. A. A. Utt, formerly associate in food analysis. This method makes use of a mixture of sulphuric and acetic acids. The details of the method are as follows:

1. Make up a mixture of equal parts by volume of commercial sulphuric acid and glacial acetic acid. (Add the sulphuric acid to the acetic acid.) Allow this mixture to cool before using.
2. Warm the sample of ice cream to 105° F. and thoroughly mix by pouring and stirring. If the fat has separated, a few granules of powdered sodium hydroxide should be added to aid in its emulsification.
3. Weigh 9 grams of the well-mixed sample into a 10-per-cent Babcock milk bottle. A pipette, with a large outlet, but sufficiently small to fit in the neck of the bottle, is desirable.¹
4. Cool the ice cream to about 68° F. and add 12 to 15 c. c. of the acid mixture at about the same temperature. Shake the mixture, using a rotary motion.
5. Place the bottle in the steam bath or hot water and heat with occasional shaking until it turns a dark chocolate color.
6. Remove from the steam bath and allow to stand 10 minutes.
7. Place in a centrifuge (preferably a steam centrifuge) and whirl 10 minutes.
8. Shake the bottle again, using a whirling motion. Fill it to the neck with hot water and mix. If a precipitate forms on the addition of hot water add a few more c. c. of the acid mixture.
9. Whirl three minutes and add boiling water to bring the fat column into the neck of the bottle.

1. In some cases the ice cream sample will separate into two layers, to such an extent that it is impossible to weigh out an accurate sample by the method given above. In such cases good results may be obtained by pouring the well-mixed sample into the test bottle from a beaker in which it is agitated every few seconds by a rotary motion. If more than 9 grams is poured into the bottle the correct weight may be obtained by removing the excess under constant agitation. Care must be taken to see that there is no water in the test bottle.

10. Whirl two minutes.
11. Place in a hot water bath (130° F.) for 10 minutes. Read from the bottom of the fat column to the extreme top of the meniscus. Multiply the reading by 2.

TESTING CONDENSED MILK OR BUTTER

The authors do not advise the testing of condensed milk or butter by station operators. Special apparatus and very great care are necessary to secure accurate results, and the products mentioned should be sent to the office of the dairy commissioner for analysis.

PREPARING SAMPLES FOR ANALYSIS

In order that analyses of samples of milk or cream sent to the dairy commissioner may have commercial or legal value, they should be prepared and sent in the following manner:

1. Select a dry, clean sample jar or bottle, having a capacity offrom 2 to 4 ounces.
2. See that the jar or bottle is provided with a tightly fitting screw cap or cork.
3. If a screw cap is used, place a paraffined milk-bottle cap inside the lid.
4. Pour the milk or cream from one can to another at least three times—until the mixture is smooth and free from lumps. Take the sample from the center of the liquid.
5. Fill the sample bottle full and apply the cover tightly. If the sample is likely to be more than 24 hours in transit, add two drops of formaldehyde to prevent the development of bacteria.
6. Allow the sample to stand upside down on white paper for an hour to ascertain whether the cover leaks.
7. As an extra precaution, dip the cover and neck of the filled jar in melted parafin several times, or seal with wax.
8. Wipe the sample bottle clean and dry, wrap it in white paper and pack it with plenty of soft white paper in a small wooden or pasteboard box. Mail it or send it by prepaid express.
9. Send with the shipment a letter stating the name and address of person who took the sample, of the person whose milk or cream was sampled, and of the person to whom analysis is to be sent.

10. State definitely what tests are desired, whether for butterfat, solids, adulterations, or preservatives.

This service is rendered free of charge to residents of the state. About 10 days are required for an analysis to be made and reported upon. Should samples arrive in a leaky or unsatisfactory condition no test will be made, but the sender will be notified of this fact and of the probable cause of the trouble.

On request, accompanied by 10 cents in stamps to cover postage, a special sample bottle and mailing case will be furnished applicants who desire to have milk or cream tested. Address: State Dairy Commissioner, Manhattan, Kan.

COMPOSITION OF MILK, CREAM, AND SKIMMILK

The following figures will enable persons receiving the results of an analysis to compare their figures with those for normal milk, cream, and skimmilk. It should be understood, however, that the figures below are not the legal standards, but merely the results of average and typical samples. Average milk contains:

87.4	percent water
3.7	percent fat
3.2	percent casein and albumin
5.0	percent milk sugar
.7	percent ash
<hr/>	
100.0	

Casein and albumen are the constituents of milk which enter largely into the making of cheese. Milk sugar is the constituent which is acted upon by bacteria in the souring of milk. The ash is the mineral matter.

When milk is skimmed to a 36 percent cream the composition of the skimmilk and cream becomes about as follows:

<i>Cream</i>	<i>Skimmilk</i>
57.0 percent water	90.2 percent water
35.0 percent fat	0.1 percent fat
3.5 percent casein and albumin	3.6 percent casein and albumin
4.0 percent milk sugar	5.3 percent milk sugar
0.5 percent ash	0.8 percent ash
<hr/>	
100.0	100.0

OFFICIAL TESTING OF WEIGHTS, SCALES, AND GLASSWARE

In addition to testing samples of dairy products free of charge, the dairy commissioner offers to test and certify to the accuracy of weights, cream scales, and glassware under certain conditions.

Weights used in cream testing and for moisture tests, namely, 9-, 10-, and 18-gram weights, must be accompanied by 6 cents in stamps to cover mailing them and a report on their accuracy. Weights which are found to be accurate will be returned in a sealed package, bearing the seal of the dairy commissioner's office. Weights which are inaccurate will not be returned, but the sender will be notified of the degree of error. The maximum degree of error allowed is one-tenth of one gram. The dairy commissioner does not sell weights, but persons wishing new weights tested may have them sent from the supply houses to the dairy commissioner, who in turn will send them to the person ordering same. All packages must be accompanied by stamps, and must be marked plainly with the name and address of the person to whom the weights are to be sent.

The dairy commissioner does not undertake to repair broken scales or to adjust scales which are in poor condition as the result of abuse, but in so far as such work will not interfere with his regular duties, he will, at the time of inspection, test doubtful cream scales for accuracy.

Glassware on which the accuracy of the test directly depends, namely, test bottles and milk pipettes, are required by law, section 6, to be officially tested and to be marked with the initials "S. D. C." Inaccurate glassware is a frequent cause of inaccurate tests. To control this situation, all milk and cream bottles and milk pipettes sent to the office of the dairy commissioner by mail or prepaid express will be tested, and those found accurate will be marked with the initials "S. D. C.," for which service a nominal charge of 3 cents apiece will be made to cover actual expenses connected with such testing. Remittance may be made by money order or by stamps.

Glassware found to be inaccurate will be destroyed. Shipments of glassware ordered from creamery supply houses may

be sent to the dairy commissioner's office for testing upon the same terms. Postage must accompany packages to be mailed. Express packages will be sent "collect."

CHECKING OUT WITH THE CREAMERY

PROVISIONS OF THE LAW

Section 6 of the state dairy law provides that all tests shall be within 1 percent of the exact amount of butterfat contained in the cream as determined by test of the state chemist made on samples taken by the dairy commissioner or his deputies. Where a shortage or surplus exceeding that amount is found, either in individual deliveries or in shipments to the creamery, the tests made by the operator are classed as inaccurate, false, or fraudulent and he is subject to the penalties provided in section 11. Whether the error was due to carelessness, incompetence or willful manipulation, the operator will be considered unfit to sample or test cream and his permit will be promptly canceled.

The Babcock test in itself is accurate; and where errors occur, the trouble is found to lie in a variety of causes, all of which can be remedied by the observing operator.

WHAT TO DO IN CASE OF SHORTAGE

When the creamery reports a shortage of butterfat, first compare the number of cans and the net weight of the cream shipped from the station with the figures reported by the creamery.

If these figures agree, the fault lies probably in the sampling or the testing, and the test given has for one or more of the following reasons been too high:

1. Neglecting to take the sample in the manner described in the chapter on sampling.
2. Failure to keep sample jars tightly covered.
3. Keeping sample jars in too warm a place.
4. Taking more than a 9- or 18-gram sample.
5. Including mineral matter or curd in the test if not clear.
6. Failure to keep the tests at from 135° to 140° for 10 minutes when glymol is used.
7. Slipping of dividers.
8. Inaccurate glassware.
9. Use of dirty or incompletely washed test bottles.

WHAT TO DO IN CASE OF EXCESS

If an excess of butterfat is reported when cans and weights agree, the tests given have been too low, and more butterfat has been received than was indicated on the operator's report. The cause may have been due to inaccurate sampling, as noted before, or for one or more of the following reasons:

1. Taking less than a 9- or 18-gram sample.
2. Running the tester at too low a speed.
3. Failure to keep tests at 135° to 140° for 10 minutes with glymol.
4. Inaccurate glassware.
5. Slipping of dividers.
6. Carelessness in reading the proper figure.

THE COMPOSITE TEST AND REASONS FOR TAKING IT

A composite test is one made from a sample which represents the total cream bought from two or more patrons; or different deliveries from the same patron. Every station operator should make a composite test of every shipment of cream, both as a protection and as a source of satisfaction to himself.

HOW TO MAKE A COMPOSITE TEST

There are two kinds of samplers used in obtaining the samples; namely, the stirring-rod and the McKay sampler. The sample is obtained from a shipment of cream as follows:

1. Weigh all the cans in the shipment and get the net weight of the cream.
2. When using the stirring-rod be sure to have the same amount of cream in each can and sample each separately according to law (stirring and pouring) and take a proportionate sample from each one; that is, a 2-ounce sample jar full.
3. When using the McKay sampler be sure to have cans of the same diameter. It does not make any difference how much cream is in each can. Then sample each can separately as described on page 33.
4. Place the sample from each can in the inner vessel of a double boiler. Warm this to a temperature of 100° F., mix by pouring, take a sample and test it. This represents a composite of all cream in the shipment.

The number of pounds in the shipment multiplied by the composite test gives the pounds of butterfat, and if the work

has been done correctly this should check with the pounds of butterfat, as shown on the daily report. Any error reported may logically be due to some mistake on the part of the creamery, or loss of butterfat in transit. The composite test is not the numerical average of the individual tests unless every patron delivers exactly the same number of pounds of cream.

It is necessary to have a separate report of each shipment of cream, and if any cream is received after the shipment is made, make this entry on the next day's report.

The total weight of the cream must be obtained, due to the fact that water is used to rinse out the patrons' cans, and this is added to the cream. This rinse water will not affect the pounds of butterfat, since the lowering of the tests by the addition of the rinse water will be exactly compensated for by the increase in weight.

WHAT TO DO WITH CREAM HELD OVER

Some operators hold cream over from one shipment to another, which makes it difficult for this department to check up on an operator, because it is impossible to tell the amount of butterfat in cream held over only by weighing, taking a sample, and testing it. The following is required of each operator:

Any can which is at least half full of cream should be shipped and not held over. In case cream is held over the operator is required to weigh, sample and test it, and figure the pounds of butterfat, making a notation at the bottom of the daily report.

On the next day's report the weight, test, and pounds of butterfat of the cream held over should be entered at the top of the report.

Thus, each day's report must show at the top the weight, test, and pounds of butterfat of any cream held over from the day before and also at the bottom the weight, test, and pounds of butterfat of any cream held over after this day's shipment is made.

This department can check up on the work of the operator and the creamery by taking a composite sample and having it tested by the state chemist and comparing this result with that of the station operator and that of the creamery.

STATION CHECK BLANK

The station check blank here outlined will assist the operator in checking up his shipments and protecting himself against charges of inaccurate testing:

Place..... Date.....
 Operator.....

Cream received as shown by entry sheet and individual tests			Cream received as shown by composite test				Error		
Total deliveries received	Pounds of cream received	Total pounds of fat to be paid for	Gross weight of cream and cans	Weight of cans	Weight of cream including wash water	Comp. test	Total fat	Short	Over

Remarks.....

Pounds, over from last shipment..... Test.....

Pounds not shipped today..... Test.....

THE MCKAY SAMPLER

The McKay sampler is a device for taking a vertical sample of milk or cream, which shall truly represent the richness of all portions. The amount of the sample also conforms to the amount of cream in the can. Since the ingredients of milk and cream tend to separate quickly on standing, a vertical column of the entire amount is a more nearly accurate sample than the same amount taken from any one portion of the cream. The McKay sampler consists essentially of two tubes, one within the other, as illustrated in figure 19. Each tube is provided with a short horizontal handle, and each has vertical portions of one side removed. By turning the handles the sampler may be opened or closed. The sampler is used as follows:

Insert it, closed, in the can of milk or cream to be sampled, until it touches the bottom, keeping the tube vertical during the process. Open it by turning the handles. When it is full, close it and withdraw it, removing all adhering cream from the outside of the sampler. Carefully empty the contents into the inner vessel of a double boiler, the outer vessel of which contains hot water. If the cream sampled is very thick, use the plunger (also illustrated) for removing all the cream from the inside of the sampler. The best results are obtained when the sampler is kept warm. Always stir the cream thoroughly before using this sampler.

CREAM GRADING

Butter made by creameries in Kansas must compete with butter made in Minnesota and Wisconsin. The butter from these states is made from cream delivered to the factory in far better condition than is our Kansas product. The market reports show that butter made from good cream is worth several cents more per pound than butter made from poor cream. Therefore, good cream and poor cream should be kept separate. The creameries have modern equipment and efficient men, but it is impossible to make first-grade butter from second-grade cream. It costs more to produce good cream and it takes more time, thus the person who takes extra time should receive some compensation for so doing.

When cream is graded the farmer who produces good cream gets paid for his extra time and work, while the one who sells second-grade cream gets penalized for his careless methods, which is 3 cents less per pound of butterfat.

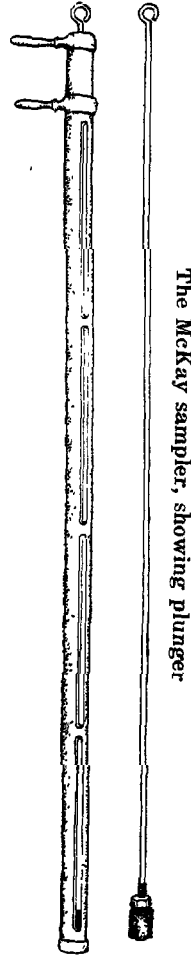
The creameries can make first-grade butter out of first-grade cream. They can find suitable markets, thus are able to receive larger returns, and in turn pay the farmer more for his cream. This means larger profits to the farmer, and stimulates the dairy industry. It is evident from these facts that cream should be graded.

Rule 18 of the Kansas dairy law is as follows:

Rule 18.—All cream shall be graded according to the following rules, and each grade shall be kept in a separate can, plainly marked to indicate the grade contained therein:

1. First-grade cream shall consist of cream that is clean, smooth, free from all undesirable odors, clean to the taste, and sweet or only slightly sour.

2. Second-grade cream shall consist of cream that is too sour to grade as first, that contains undesirable flavors or odors in a moderate degree.



The McKay sampler, showing plunger

FIG. 19.

that is foamy, yeasty, or slightly stale, or that is too old to pass as first-grade cream. All sour cream containing less than 25 percent butterfat shall be graded as second grade.

3. Unlawful cream shall consist of cream that is very old, rancid, moldy, dirty, or curdy, and such cream shall not be purchased, sold, or used for food purposes.

Practical cream grading work has been carried on at the examination points during recent years. It has been found that the operators of Kansas cream stations can grade cream satisfactorily. Although some were not able, in every instance, to distinguish between the various off flavors, they could taste cream and tell good cream from bad cream.

Each operator of a cream receiving station is required to grade all cream purchased and to tag and ship it as first or second grade. Also all creamerymen are required to grade all cream purchased by them.

The only way to grade cream is by smelling and tasting, and each operator is required to taste each patron's cream, provided it is not spoiled and unfit for food.

To grade a delivery of cream, take off the lid and note the appearance and odor of the cream. Then stir and taste it. It is not advisable to swallow it, for all cream will soon taste alike.

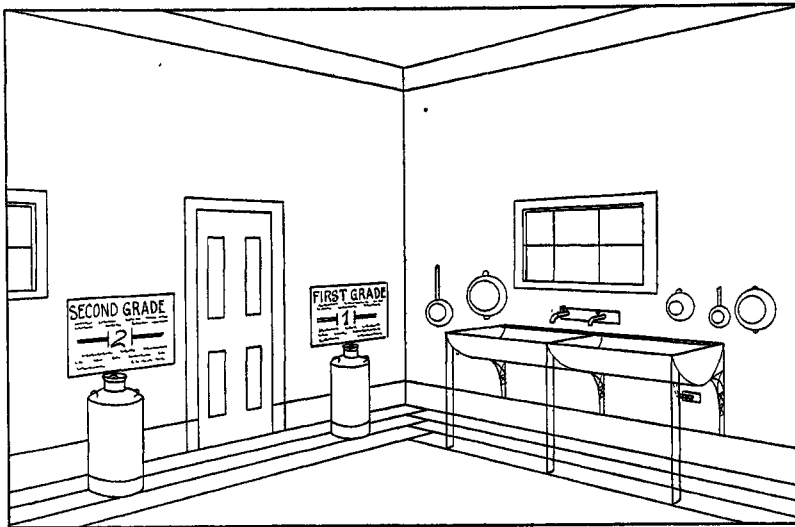


FIG. 20.—Interior of cream station, showing location of grading placards

Note the after taste and grade accordingly. If unfit for food refuse to accept it.

Each operator is required to keep a record of the grade of each patron's cream, so that the inspector can look at the daily report and see how he has graded the cream. The report must show that sour cream testing less than 25 percent is second grade.

In every station the first-grade and the second-grade placards should be tacked on the wall about 3 feet from the floor, or just above the cans and at least 2 feet apart. On opposite sides of the room is permissible, but be sure to have them in plain sight. (Fig. 20.) Put first-grade tags on the cans and keep them by the first-grade placard. Always keep a red second-grade tag on a can and by the second-grade placard, then grade the cream and empty it into the cans while by the placards.

From data collected it has been found that the reason for the farmers' having poor cream is lack of proper care in handling the milk and cream. It is possible for them to produce first-grade cream with moderate equipment.

First-grade cream can be produced by observing the following:

1. Before milking wipe the cow's udder with a damp cloth.
2. Milk the cow immediately, using a small-top milk pail.
3. Remove the milk from the barn immediately.
4. If the milk is not separated at once, cool it down to remove the animal heat.
5. If separated, separate a 35 to 40 percent cream.

Objections to thin cream:

- (a) Extra skimmilk sours, and becomes second grade.
- (b) Loss of skimmilk, which is a good food,
- (c) Increase cost of transportation, and increased space needed.

Objections to thick cream :

- (a) Loss of butterfat in the skimmilk.
 - (b) Mechanical loss due to cream adhering to cans and utensils.
6. Wash the separator and utensils each time they are used.

7. Cool the cream immediately and keep it cool.
8. Never mix warm cream with cold cream ; always cool the warm cream first.
9. Stir the cream two or three times daily.
10. Never allow it to freeze.
11. Deliver as required by section 8 of the Kansas dairy law, which reads as follows:

Cream to be used in the manufacture of butter, that is not delivered to point of shipment within 24 hours after milking, must contain not less than 25 percent of butterfat, and shall be delivered in wholesome condition.

No part of any shipment of cream to be used in the manufacture of food products shall be more than 3 days old when delivered to the point of shipment during the months of May to October, inclusive, and 4 days old during November to April, inclusive.

Such cream must not be delivered at the point of shipment more than one hour before the schedule time of the train on which it is to be shipped, unless kept in a protected, cool, and sanitary place, free from foul odors.

12. Keep the cans or receptacles covered while delivering to the market in warm weather.

Cooling cream immediately is essential. H. W. Conn, of Connecticut, has found that one bacterium kept at a temperature of 50° F. for 24 hours will multiply to seven, while one kept at 70° for 24 hours will multiply to 700.

The use of a cooling tank is recommended. It is best to have one that can be fixed so all the water passes through it which is pumped from the well to the watering trough. (Fig. 21.) The cream is thus cooled and is kept cooled and first-grade cream is the result.

The temperature of cream under farm conditions based on 115 investigations made during July and August in Kansas, is as follows :

	Degrees F.
Average temperature of cellar	72
Average temperature of wells and springs	58
Average temperature of porches and kitchens.. ..	90
Average temperature of cream kept in cellars or caves and on porches.	75.7
Average temperature of cream kept in wells, water tanks and springs.....	61.7
Difference in temperature in favor of wells, water tanks and springs.	14

Cream 24 hours old, if held at a temperature of 76.7° F., will be inferior in quality to cream 48 hours old if held at a temperature of 61.7° F., other conditions being similar.

*Do not keep milk or cream in caves or cellars, or on porches.
 Keep milk and cream in wells, water tanks, and springs.*

Flavors and odors found in cream are as follows:

Metallic.—A cream with metallic flavor is always second grade or un-

lawful. It is caused by cream coming in contact with rusty or poorly tinned separators, cream cans, or other utensils.

Weedy.—Cream with this flavor is also second grade or unlawful. It is caused by cows eating large quantities of wild onions, ragweed, or other strongly flavored plants. It is most prevalent in early spring or during a period of short pastures. Do not turn cows into a pasture until it is well started. When first turning cows on pasture in early spring, keep them in the feedlot or stable during the night and feed some dry roughage. Take them out of pasture two hours before milking in the evening.

Oily.—Oily flavor is always unlawful, and is caused by having cream near coal oil, gasoline or similar products; also by carelessness in handling separator oil, or by using cans in which any of these products have been handled.

Cheesy.—Cheesy cream smells and tastes like cheese. It is caused by keeping cream at too high a temperature—at or near 90° F.—after it has come in contact with a dirty separator or any other utensil. It is always second grade or unlawful.

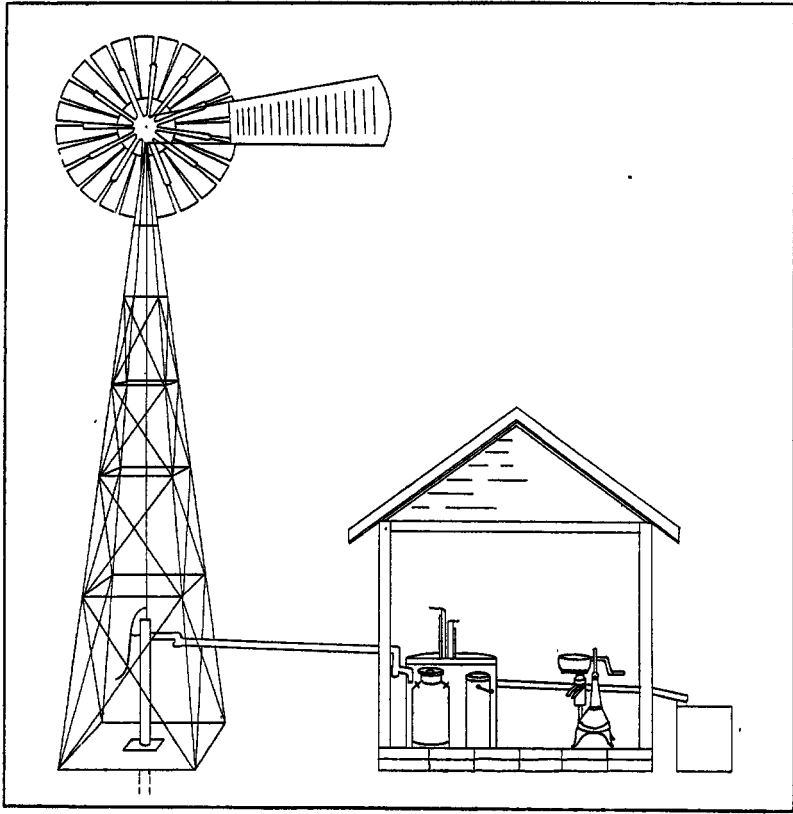


FIG. 21.—View of milkhouse, showing cooling tank and water connections

Greasy.—Greasy cream is always second grade or unlawful and has a lardy or tallowy taste. It is caused by the cream coming in contact with a dirty separator or other dirty utensil. Greasy cream is dirty cream and is invariably too old.

Bitter.—Bitter cream has a taste resembling that of quinine. It is cream which has been held too long, though at a low temperature. It is always second grade or unlawful.

Colostrum.—Colostrum cream is taken from milk produced by a cow on or before five days after calving. The sale of colostrum milk or cream is prohibited by the dairy and pure-food laws.

Yeasty.—Yeasty cream is that which has a tendency to foam and which smells yeasty. It is caused by dirty separators, by other dirty utensils, or by exposing the cream to dust or dirt, and is always second grade or unlawful. Cream develops foam only when held at a high temperature.

Stale or Musty.—A stale or musty cream is always second grade or unlawful, and the terms need no explanation. Stale cream is caused by holding cream too long or in stale cans, or by using stale water in washing or rinsing the cans. Musty cream is the result of holding cream in a cave, cellar, or room having stale or musty surroundings.

Very Sour.—Very sour cream has a very high acidity, and is always second grade or unlawful. It is the result of holding cream too long and at too high a temperature.

Medium or Slightly Sour.—Slightly sour or medium sour cream has a clean acid taste, and is first grade if it has a desirable odor.

Sweet Cream.—Sweet cream is cream which will not curdle in hot water, tea or coffee, and is always first grade if free from objectionable odors.

POINTS THE OPERATOR SHOULD REMEMBER

First-grade cream will make first-grade butter. One should be willing to drink a sample of any cream paid for as first grade. Is this test always applied? Any dairyman, before objecting to the operator's decision, when his cream is graded second, should decide whether he would be willing to drink a portion of his own cream.

SYSTEM OF EXAMINATIONS, PERMITS, AND INSPECTIONS

PROVISION OF THE LAW

As provided in section 9 of the Kansas dairy law, any person desiring to sample or test cream must first secure a permit bearing the seal and signature of the dairy commissioner, which is good for a period of three years.

EXAMINATIONS

Examinations are of two classes—temporary and final. Persons passing the temporary examination will be granted a temporary permit, which is good until the final examination is held, in the section of the state in which said party is located. Failure to take the final examination when the person is notified to do so revokes the temporary permit. Persons passing the final examination will be granted an ungraded permit until their place of business can be officially inspected, unless the station has been previously scored.

PERMITS AND INSPECTIONS

Three grades of permits will be issued, according to the condition in which the station is found at the time of inspection. The operator of a clean, attractive station, provided with a full equipment and scoring 85 or more at the time of inspection, will receive a first-grade permit, bearing a blue seal. If the station is untidy or less well equipped, and scores between 70 and 85, the operator will receive a second-grade permit, bearing a red seal. In case the station scores less than 70, or shows evidence of neglect or carelessness on the part of the operator, but does not violate the provisions of the law, a third-grade permit, bearing a yellow seal, will be granted. The grade on the permit may be raised or lowered, depending upon the condition of the cream station at the time of the next inspection. It is, therefore, advisable to keep the station clean at all times.

Where the station is insanitary, if the permit held is not in a conspicuous place, or if other provisions of the dairy law are violated, the permit will be canceled and the station closed up.

The purpose of this system is to improve the quality of Kansas butter by raising the standard of cream stations in the state. The cooperation of all is urged to that end. Requests for inspections will be acted upon in due course of time, but under no circumstances will a particular date for an inspection be named. Where it is plainly evident that special sanitary preparations have been made for the visit of the inspector, another inspection will be made.

POINTS CONSIDERED IN SCORING A STATION

An ideal cream room would score 100 percent. To determine the score of a station, the point in question is compared with the ideal. For example, if the room under inspection is

only one-half as good as the ideal in that particular, the score given would be one-half of the points allowed. The following are the points considered in scoring all dairy buildings:

External Appearance.—Points allowed, 10. The outside portion of the station should be neat and clean in appearance and be provided with some sort of a porch and platform. If a frame building, it should be painted.

Neatness of Surroundings.—Points allowed, 10. The surroundings of a cream station should be sanitary in every sense of the word, as cream readily absorbs any undesirable odors, and decayed substances harbor flies. Stations should not be located within 50 feet of chicken yards, hog pens, barnyards, etc., or open into rooms in which oils, poultry, eggs, or other strongly flavored products are handled.

General Equipment.—Points allowed, 10. To make a lawful test the necessary equipment must be provided for each station, and operator's permit must occupy a conspicuous place on wall.

Freedom from Flies.—Points allowed, 10. Stations must be provided with screens and other protection, such as fly traps, when necessary.

Neatness of Interior.—Points allowed, 10. A well-arranged neat station facilitates the operator's work. Suitable places must be provided for bottles, scales, etc., and articles kept therein.

Walls and Ceiling.—Points allowed, 10. Walls and ceilings should be finished with a hard surface; cement when possible. Tight-fitting boards painted in some light color are next in desirability. The surfaces of walls and ceilings must be kept clean and free from dirt.

Cleanliness of Floor.—Points allowed, 10. The desirable station floor is of cement, which can easily be kept clean. Tight-fitting, well-painted boards are satisfactory. The station floor must be scrubbed whenever necessary, and must be kept free from dirt and litter at all times.

Cleanliness of Utensils.—Points allowed, 10. All station utensils must be kept scrupulously clean at all times. No excuses will be accepted. Stirring-rod, sample jars, bottles, and all vessels coming in contact with the cream must be washed thoroughly each day.

Ventilation and Light.—Points allowed, 10. A station must have at least one-fifth as much window as floor space. Sunlight is an excellent disinfectant, and light is necessary if the operator is to do efficient work. Whenever possible the building should have openings on at least two sides. Good ventilation keeps the room cooler than it would remain otherwise. A cool room is essential for keeping good cream.

Drainage.—Points allowed, 10. A station should be located on a well-drained, slightly elevated spot, sloping away from the station in all directions. Stagnant water or muddy holes are a detriment to the cream business as well as insanitary.

HOW TO MAKE APPLICATION FOR EXAMINATION

Write to State Dairy Commissioner, Manhattan, Kan., and request an application blank. Or in case creamery field superintendents can furnish the official blanks (with which they are supplied at frequent intervals) fill out the blank and mail it to the dairy commissioner, together with 26 cents to cover postage.

If the final examination is scheduled at a convenient point for a date within 30 days from the time the application is received, no temporary examination will be granted, except in emergency cases, because the applicant would hardly have time to get a temporary permit before he would have to take a final examination. The applicant will be notified to appear at such place at the specified time to take his examination.

If a final examination is not scheduled, a temporary examination may be taken before a notary public in the town where the applicant resides. Applicants for temporary examination must be at least 18 years of age, and must have tested, prior to the time of their application, at least ten samples of cream and two of milk under the supervision of a person holding a permit and according to the directions printed in this bulletin. Persons who have taken the temporary or the final examinations and persons who have previously held a permit are not eligible. Should the applicant fail to pass, a second temporary examination will be granted him. Not more than two temporary examination papers will be issued, but an applicant with a good record, who is sincere in his efforts to secure a permit, may take as many final examinations as he chooses. Failure to appear within 10 days before a notary public, when the applicant has been notified that papers have been issued, revokes the right to subsequent temporary examinations, unless satisfactory reason is given. Sickness will not be accepted as an excuse unless certified to by a notary public or the attending physician.

Station operators holding special or temporary permits, or three-year permits about to expire will be notified of the place and date of the examination at which they are to appear.

Permits are not transferable; neither is it lawful for any person to sample and test cream under another person's permit. Furthermore, the fact that one has made application for an ex-

The Permit System of Cream-Boiling .. 43

amination does not permit him lawfully to sample or test cream until he has actually secured this permit and displayed it in a conspicuous place in his station. Examination questions will cover the contents of this bulletin and the provisions of the law and rulings based thereon.

SPECIAL PERMITS

Final examinations will be held throughout the state during the year. Under extraordinary conditions, a person holding an expired final permit may be granted a special permit which will be good until a final examination is held in his vicinity, providing sufficient reasons for not taking the examination before his final permit expired accompany the request for a special permit. Only one such special permit will be issued to an operator. Persons holding expired temporary permits are not eligible to receive the special permit.

THE QUESTION OF SUBSTITUTES

If a station operator holding a permit is sick or is suddenly called away on important business, the lawful management of such a station in his absence is a problem which an operator may be called upon to solve at any time.

The best and simplest solution of this difficulty is to have a substitute holding a permit. In many cases the operator's son, wife, or daughter has taken the examination and been granted a permit, and the work may be taken up by such a substitute without interruption. When no person holding a permit can be secured and the operator expects to be absent for less than a day, as competent a person as possible should be secured and the cream merely received and placed in separate cans. The sampling and testing is done by the operator when he returns. Under no circumstances, except as stated in the emergency ruling, is it lawful for a person not holding a permit to sample or test milk or cream.

EMERGENCY RULING

If an operator leaves a cream station without notice, the field superintendent may procure the services of the best man available, instruct him thoroughly in the proper methods of testing and allow him to sample and test, provided that said party sends in an application to the dairy commissioner not later than the day he takes charge of the station, and that 10 days from that date he have in his possession a permit entitling him to

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the privileges of a cream buyer. A letter from the field superintendent must accompany the application stating why it is an emergency case.

**RELATION BETWEEN THE BUYER AND THE DAIRY
COMMISSIONER**

The dairy commissioner is charged with regulating and directing the development of the dairy industry in Kansas along the lines established by law. The policy of regulation is two-fold. It consists, first, of encouraging those doing a legitimate business to extend their business, and, second, to punish by law, or to eliminate from the commercial field, persons handling dairy products in an unclean, unscrupulous or dishonest manner. The attitude of the dairy commissioner and deputies toward a person engaged in handling dairy products is therefore determined by the attitude of such person toward the law. But in all cases inquiries or correspondence bearing on the scope of the work will receive prompt and careful attention, to the end that all may be fully informed.

A WORD TO CREAMERY FIELD SUPERINTENDENTS

The standard of cream stations in Kansas can be raised to a very great extent by efficient work on the part of field superintendents. The majority of superintendents are well informed on dairy matters and thoroughly understand the testing and handling of milk and cream. They are able to exert a very beneficial influence by making the buyers interested in their work and by giving them a friendly warning when the station does not conform to the dairy law. Every visit of a field superintendent should be a critical inspection. Less leniency on the part of creamery field superintendents will materially reduce the number of stations which the dairy commissioner and deputies are obliged to close every month because of insanitary conditions or violation of the law.

In case the instructions of field superintendents are not heeded, the latter are urged to report the conditions and circumstances, and an official inspection will be made.

SYSTEM OF INSPECTIONS AND COMPLAINTS

The law provides for the inspection of all places of business where dairy products are handled. In making inspections of cream stations, the dairy commissioner and his deputies will

give the operator a written report of conditions found, together with such written instructions as they may deem necessary. A second copy of the inspection report will be sent to the creamery or company represented, and a third will be kept on file in the dairy commissioner's office.

The law also provides for official action on all written complaints or reports wherein are given the names and locations of persons violating the state dairy law. The investigation of complaints supersedes the general inspection. Any person may file a complaint with reference to matters which come under the jurisdiction of the dairy commissioner.

THE CONTROL OF FLIES

The fly is one of the most formidable enemies of pure dairy products and of health, but it can be controlled:

First, and best, by the use of well-fitted screens.

Second, by fly-catchers of a wide variety of makes.

Third, by removing from the vicinity all matter in which flies commonly breed. Fly poison of any description must not be used in or about the cream station.

Flies in cream stations and dairy establishments will not be tolerated, and no excuse will be accepted for their presence. Torn screens should be immediately replaced. The lower portion of screen doors, which usually wears out quickly, should be protected by a heavy, course-mesh screen or by wooden slats.

From March 1 to November 1, and at all times when flies are prevalent, places where dairy utensils, milk-bottle caps, and containers of dairy products are kept must be protected against flies, either by screens, or by being kept under cover, or by both. Readers are urged to correspond with the State Board of Health, Topeka, Kan., for additional information on the control of the house fly.

DEALING WITH THE DISSATISFIED PATRON

The cream buyer is indeed fortunate who does not have to contend with one or more patrons who are continually dissatisfied with their tests, the price, and their treatment in general. Experience has shown that a patron of this sort is best handled as follows:

Give him courteous treatment, but no favors.

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Refrain from arguing with him about his cream.

Do not test a sample of his cream delivered elsewhere unless you personally take the sample of his cream.

Be frank and open with him, and invite him to see his cream weighed, sampled and tested in accordance with the rules of this bulletin.

COMMON STATION DIFFICULTIES AND THEIR SOLUTIONS

Question. How is sour milk sampled and tested?

Answer. Do not attempt to sample sour milk. A sample of milk to be tested should have been kept sweet by the addition of a preservative such as formaldehyde or a corrosive sublimate tablet.

Q. What are the principal causes of curd at the bottom of a cream test?

A. The addition of water before the acid had completely dissolved the curd; the use of too weak acid; failure to mix thoroughly; insufficient speed of Babcock tester.

Q. What is the cause of dark specks in the test?

A. The use of hard water is the chief cause.

Q. Is smoking permissible in a cream station?

A. No. Tobacco smoke is considered a contaminating influence. Operators are authorized to post a notice in their stations bearing the words:

NO SMOKING
BY ORDER OF STATE DAIRY COMMISSIONER

Operators as well as patrons and visitors must conform to this requirement.

Q. How full should cans be filled?

A. The amount of cream in a can must be determined by the condition of the weather and the cream. For average conditions, figure 22 shows the proper depth to fill cans.

Q. How should twelve test bottles be arranged in a 24-bottle tester consisting of twelve double pockets?

A. Each set of pockets should be considered a unit, and each unit should be balanced on the other side of the tester by another unit. Figure 23 shows how the bottles should be arranged.

Q. Is it necessary to place weights and bottles in the center of the scale pan when weighing out cream samples?

A. With most scales this practice is unnecessary, but with some styles of torsion balances a very noticeable error will result if it is not done. Test your scales for this defect.

Q. What should be done in case acid gets on the flesh?

A. Rinse the flesh quickly with a large quantity of water; and, in case the burn is serious, apply baking soda, washing powder, or dilute ammonia. Never use the mouth on a pipette for measuring out acid.

Q. How can dirty test bottles be cleaned when all ordinary methods fail?

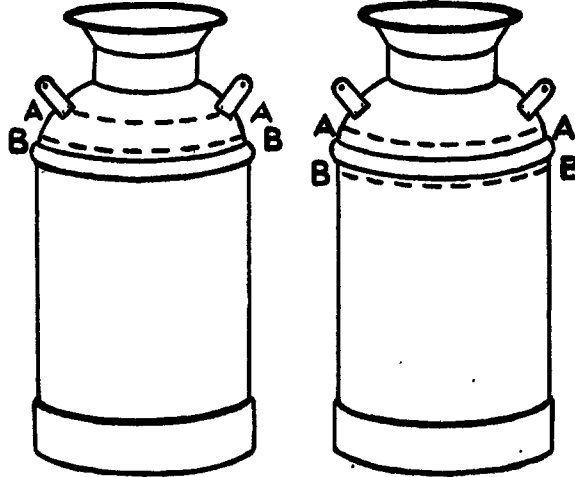


FIG. 22.—First-grade cream (left): AA, Height in cool weather; BB, height in warm weather. Second-grade cream (right): AA, Height in cool weather; BB, height in warm weather

A. Put enough strong acid in them to cover the bottoms. Let them stand over night. Then empty them and boil them in strong lye water for an hour. Fill them half full of small shot and shake them well, then use a brush. Finally rinse the bottles with clean, warm, soft water.

Q. What is the cause of dark or burnt tests?

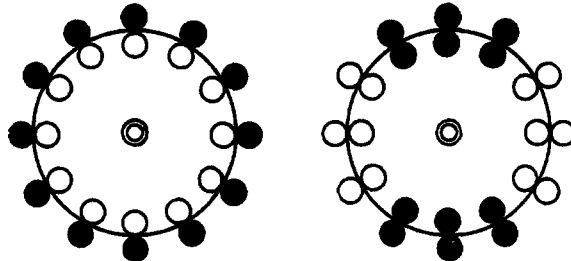


FIG. 23.—How to balance the tester: left, incorrect way; right, correct way

A. Too much acid has been added; the acid has been allowed to act on the cream too long; or the bowl of the test bottle is of too small capacity. If the temperature of either the acid or the cream exceeds 70° F., the tests are likely to be burnt.

Cans of cream having a tendency to foam over should have a small piece of ice dropped into them just before shipment. This treatment checks the growth of bacteria which cause cream to foam, thus preventing it from foaming over, and incidentally reducing a large amount of the shortage which usually occurs during the hot weather.

PATRONS' QUESTIONS AND THEIR ANSWERS

1. Patron. Why was my test lower than last time?
Operator. Authorities have found that any of the following circumstances will cause the cream test to drop considerably:
 - (a) More water or skimmilk than usual was used in flushing the bowl of the separator.
 - (b) The speed of the separator was too low.
 - (c) The separator was incompletely washed.
 - (d) Milk was allowed to flow into the separator bowl too rapidly.
 - (e) Separator was not level.
 - (f) Richness of the milk.
 - (g) Temperature of the milk.
2. P. Does sweet cream test the same as sour cream?
O. Yes. The amount of butterfat in the cream is not affected by souring, but cream in bad condition is more difficult to sample. The better the cream, the more accurate the test will be.
3. P. What is the best breed of cows to keep when cream is sold?
O. The Jersey, Holstein, Guernsey, and Ayrshire are considered the best.
4. P. What are the poorest breeds for dairy purposes?
O. All breeds which are raised chiefly for beef.
5. P. How can I tell my best cows from my poorest?
O. By weighing all the milk produced by each cow in a year and testing the milk for butterfat at monthly intervals.
6. P. How much milk and butterfat should a dairy cow give in a year?
O. At least 6,000 pounds of milk and 225 pounds of butterfat. Under Kansas conditions a cow must give 4,000 pounds of milk or 160 pounds of butterfat to pay for her keep. The greater the amount above that, the more profitable is the cow.
7. P. Is the Babcock test always accurate?
O. Yes, if properly handled.
8. P. What protection has the patron against inaccurate testing?
O. All persons paying for cream on the basis of the Babcock test must first pass an examination and secure a permit granted by the state. Every operator is examined at least once every three years.
9. P. Are silos a success, and is silage a good winter feed?
O. Yes, decidedly so, if the silos are properly made and filled.
10. P. What causes cream to become sour?

- O. The action of bacteria. The souring of cream is delayed by—
 (a) Producing under clean conditions.
 (b) Keeping it cold.
11. P. What is the best time of the year for cows to freshen?
 O. In October or November, provided the young calves are given adequate winter shelter. A cow freshening in the fall produces from 30 to 40 more pounds of butterfat in a year than the same cow freshening in the spring. Moreover, most of the additional butterfat is produced when prices are highest.

LIST OF QUESTIONS ASKED CREAM STATION OPERATORS IN EXAMINATIONS OF 1918

Answers can be found in this bulletin and in the Kansas dairy law.

1. Describe in detail a lawful method of sampling and grading cream. How should frozen or lumpy cream be sampled?
2. Describe in detail a lawful method of testing cream, including temperatures, baths, method of reading with glymol, etc.
3. State in detail how you would check up your work to locate shortage. What difference is allowed between your test and the dairy commissioner's test?
4. What is a composite sample? Describe in detail how you would take a composite sample from a five-can shipment of cream. Of what value is it?
5. What is first-grade cream? What is second-grade cream? What is unlawful cream? How would you grade frozen cream?
6. What is the cause of sour cream, of weedy cream, of metallic cream, of yeasty cream? Do you taste cream before sampling? Why?
7. Why is cream that tests 30 to 40 percent more desirable than cream testing 20 percent? Give three reasons.
8. Why should cream be graded? Name five causes of poor cream in your vicinity.
9. What do you do with your cream samples after a test has been made? Why? Will you loan creamery company cans? Why?
10. Draw a sketch of a cream room. Indicate equipment and state what is handled on all sides of it.
11. How often should cream be delivered to conform with the law? State what may be handled in a cream room or a room opening into it.
12. How would you grade cream testing 18 percent, clean in flavor, smooth and slightly sour? Give three reasons.
13. Give five reasons why a farmer's separator tests vary.
14. How do you control flies in your cream room? Do you permit smoking in it? Why?
15. Describe in detail the proper method of using the McKay sampler. What is the advantage of using one?
16. State the three functions of sulphuric acid as used in cream testing.

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17. Give the law in regard to handling empty cans. How often should cream be delivered to conform with the law?

18. Give three reasons why cream grading pays.

19. On what does the grade of a permit depend? How may a second or third grade on a permit be raised to a first grade? What does a third grade indicate?

20. Why should scales be used instead of a pipette for obtaining an accurate charge of cream for a Babcock test bottle? Why do we buy cream on the test basis instead of by the gallon?

21. Describe in detail a correct method of sampling and testing milk, including baths, temperatures and method of reading.

22. What are the four breeds of dairy cattle? Which would you advise a farmer to select who desired to start a dairy? Why?

23. What is an ideal winter feed? What feeds do the farmers in your vicinity use for their dairy cattle?

24. How should the grading placards be posted in your cream room? When cream is ready for shipping how do you mark the different grades?

25. What is the best season of the year for the cow to freshen? Give three reasons.

26. How would you advise a farmer to care for his separator and other dairy utensils? How would you advise him to care for his stables and cows?

27. Describe what you consider an ideal location for a cream station. Where would you advise a farmer to keep his cream on the farm?

28. Give five ways you would advise a farmer to produce first-grade cream. Do your patrons use a cooling tank?

29. When a farmer brings you a can of cream how do you tell whether it is first or second grade? How should cream be taken care of in hot weather? In cold weather? Do you taste all cream?

30. What causes charred or burnt tests? What would you do if the acid were too strong? Too weak?

31. If a patron becomes dissatisfied how would you deal with him? How would you work up new business?

32. What causes cream to sour? How may souring be prevented?

33. Where will you keep your permit if you get one? On what does the grade of a permit depend?

34. How soon can you pay for the cream? How long does it take to make a test?

35. A delivers 42 pounds cream testing 36 percent.

B delivers 108 pounds cream testing 22 percent.

C delivers 34 pounds cream testing 45 percent.

What is the value of each man's check if butterfat is worth 40 cents per pound? How would you grade A's cream? B's cream? C's cream? Why?

36. A delivers 92 pounds cream testing 20 percent.

B delivers 32 pounds cream testing 45 percent.

C delivers 18 pounds cream testing 40 percent.

What is the value of each man's check if butterfat is worth 40 cents per pound? What is the composite test if 9 pounds rinse water were added? How would you grade each delivery of cream?

MICROORGANISMS IN RELATION TO THE DAIRY INDUSTRY

Some knowledge of microorganisms in relation to the dairy industry is necessary for all persons engaged in the production or handling of dairy products. The following brief outline is added in order to give some idea of their sources, significance, and methods of control.

Milk is one of the most universal of food products. It is also one of the most perishable. Under natural conditions milk is consumed as soon as it is drawn from the cow, but present-day methods of transportation and manufacture of dairy products make it necessary to keep milk for some time after it is drawn.

The most important problem before the dairyman of today is that of controlling the growth of microorganisms in his product. Milk and cream are often produced and handled under the most filthy conditions imaginable, in spite of the fact that under the best of conditions it is sometimes difficult to obtain a high-grade product.

NATURE OF MICROORGANISMS

By the term microorganisms we mean all organisms which cannot be seen by the unaided eye. This includes bacteria, yeasts, molds, and protozoa. The protozoa are of no interest to the dairyman, yeast and molds are of minor importance, while bacteria are of a great deal of importance. The bacteria found in milk may be classified into four general groups as follows:

1. Those having little or no effect and disappearing soon after the milk is drawn.
2. The desirable types, or those producing a clean, sharp acid flavor and odor. These types are used as starters for ripening of cream for butter making.
3. The objectionable types which cause trouble and loss from gas, bad flavors and odors, bitter milk, slimy milk, and the like.
4. Those bacteria capable of setting up diseased conditions in the animal body. The latter cause little change in the product itself, but are of great danger to the consumer.

Bacteria vary in their size, shape, resistance to heat, and in their activities. Very few types are harmful, while many are

very beneficial to man. The various forms are shown in figure 24. These are magnified about 1,500 times. These organisms are too small to be seen without the use of a high-power microscope and make their presence known only by the changes which they produce. The lactic acid bacteria cannot be seen in milk, but the fact that the milk becomes sour on standing shows that they are present. For this reason the dairyman is interested, not so much in what bacteria are, as in what they do.

These minute organisms are widely distributed in nature. It is generally safe to say that they are found everywhere in the world that other forms of life are found and in many places where other forms are not found. They are found in dust floating in the air, in water and sewage, in and on food; on the hands, in the mouth, and especially in the digestive tract and digestive excreta of man and animals. Those from the last mentioned source cause the most trouble for the dairyman.

SOURCES OF MICROORGANISMS IN MILK

Microorganisms get into milk from many sources. These may be discussed under the following headings:

STABLES

Dust has been found to carry great numbers of bacteria. Such dust settling into milk would carry large numbers of bacteria into it. The handling of feed, bedding, etc., just before, or at milking time, will be sure to fill the air with more or less dust and dirt. The feeding should be left until the milking has been finished or time enough should elapse between feeding and milking to allow the dust to settle.

The stables should be light and well ventilated. These requirements are essential to the production of good-flavored milk. Light serves two purposes: (1) That of showing up the dirt that is present, and (2) the killing of bacteria. The exposure to good sunlight for a few hours will kill almost all forms, including the disease-producing bacteria. The floor should be of cement and the sides and ceiling finished so as to catch as little dirt and dust as possible. Only such fixtures as are necessary for stalls and feeding should be allowed to remain in the stable, as all others take up space and catch and hold filth.

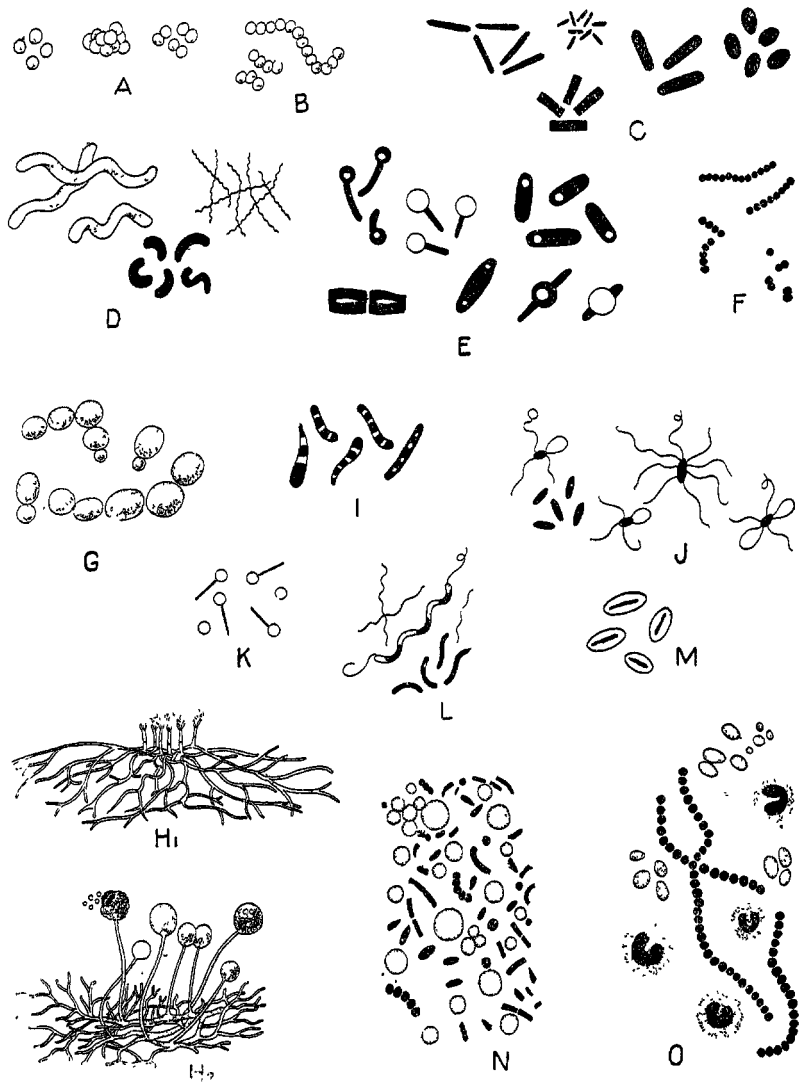


FIG. 24.—Common forms of microorganisms: A, Spherical forms of bacteria arranged in groups. B, Spherical forms of bacteria arranged in chains. C, Rod-shaped bacteria. D, Spiral bacteria. E, Bacteria showing spores. F, Bacteria causing souring of milk—lactic acid bacteria. G, Yeast cell—the cause of foamy cream. H, Molds common in milk, butter, and cheese. I, Organisms causing diphtheria. J, Rod-shaped organisms showing flagella (organs of motion). K, organisms causing tetanus (lock jaw)—spores in end of rod. L, Spiral organisms showing flagella. M, Rod-shaped organisms surrounded by capsule—similar to that causing slimy milk. N, Sketch showing the relative number and size of fat globules and bacteria in sour milk. O, Streptococci and pus cells from mastitis

All manure should be removed to a considerable distance from the stable. The yard should be well drained and kept as clean as possible, so that the cows in moving about do not drag their udders through the filth,

THE COW

From the time milk is secreted in the cow's udder it is subject to contamination by bacteria. There are various forms of bacteria that seem to inhabit the milk-ducts and get in through the opening in the teat. Most of those are drawn out in the fore-milk, while the strippings are practically free except in cases of mammitis and tuberculosis of the udder. The contaminations from the udders of healthy cows are of very little importance and can be very easily reduced by discarding a little of the fore-milk.

The external sources of bacteria in milk are perhaps the most important. Of these the cow is one of the most important. As the animals are usually kept in stables their flanks and udders become more or less covered with dirt and manure. Unless this is brushed or washed off some of it is sure to fall into the milk during milking, carrying in innumerable bacteria. Much of this might be prevented by properly grooming the animals and by washing off the udder with a damp cloth just before milking. This removes the dirt or causes it to adhere to the skin during the milking process.

MILK UTENSILS

Another very important factor in the reduction of bacterial contamination is the care used in the cleaning of the milk utensils. Under milk utensils are classed all vessels used for the storing or handling of milk, including pails, strainers, cans, separators, etc. As soon as possible after using all these should be washed with clean water to which has been added some good washing powder, then scalded thoroughly. Milk should not be allowed to dry on milk utensils, as this makes them more difficult to clean. All seams should be filled full of solder, so that they may be easily washed and all points reached by a scrubbrush. After washing the utensils should be placed in an inverted position and in the sun if possible.

Rusty utensils should not be used, as the rough places collect bacteria and are responsible for a large increase in germ content of the milk. As soon as the milk is drawn from the

cow it should be taken from the stable and strained through a clean strainer into the receiving can. The strainer is an important source of contamination unless properly cared for. The layers of cheesecloth or cotton used are of little or no account except to remove the larger portions of dirt. Bacteria are so small that they are soon washed through any number of layers once they fall upon the strainer. The strainer will cause a large increase in the germ content of milk unless it is washed and then scalded in boiling water each time after using. Straws, hairs, and bits of dirt should not be allowed to remain on the cloth, because the constantly flowing milk will soon wash them free of organisms. The organisms thus washed off go through the strainer into the milk below, where they find best possible conditions for growth.

THE MILKER

From the milker come most of the disease producing organisms which are dangerous to man. These include the organisms causing typhoid fever, tuberculosis, scarlet fever, septic sore throat, diphtheria, foot-and-mouth disease, etc.

Milking and spitting into the hands as aids in milking are vile and dangerous practices, from the fact that there is always danger of conveying disease germs from the milker to the milk.

It is readily seen that milk is subject to a great many sources of contamination, and that unless considerable precaution is taken the milk will soon be so saturated with microorganisms as to be completely unfit for use.

METHODS OF CONTROLLING GROWTH OF MICROORGANISMS IN MILK

COOLING

Cooling is the most practical method at the farmer's command for the control of bacterial growth in milk. Bacteria develop very slowly below 50° F., and if the milk is cooled below that point as soon as milked it can be kept in a sweet condition for several days longer than if left to cool naturally and kept at the ordinary temperature. Even cooling to below 70° F., as soon as possible sometimes makes a difference of several hours in the time of curdling. This means that if the milk is cooled and kept cool the cream can be delivered in a condition suitable for the manufacture of good butter. Warm milk or cream

should never be mixed with that which has been cooled, as this gives the bacteria a favorable opportunity to develop.

HEATING

This method is resorted to in a great many cases where the germ content of the milk is already high. This consists in applying a temperature of about 150° F. for a period of 10 to 30 minutes or heating to 186° F. for one minute or less. This kills most of the bacteria present and is called pasteurization. This method consumes much time and labor and requires expensive machinery. If not properly conducted it may cause a cooked flavor in the butter.

The use of heat is, however, very advantageous as it kills most of the bacteria, including the disease-producing types, and prolongs the keeping quality of the milk or cream.

THE USE OF CHEMICALS

There are certain chemicals used to destroy or prevent the growth of microorganisms in milk, but they are injurious to health and their use is prohibited by law.

MICROORGANISMS IN CREAM

In manufacturing of butter it is customary to concentrate the fat globules into cream preliminary to churning. As has been mentioned, there are a considerable number of bacteria in milk. These are collected more and more into the cream as the fat globules rise by gravity or are thrown to the center of the separator bowl by centrifugal force. For this reason, cream contains more bacteria than skimmilk.

If the cream is allowed to remain at ordinary temperature it undergoes what is called a ripening process. This is associated with the development of acid and certain flavors and odors not found in sweet cream. These changes are of a complex nature and are due to the action of the bacteria growing in the cream. Where butter is made on the farm there is a natural ripening while enough cream accumulates for churning. With the modern creamery methods it becomes necessary for the buttermaker to understand some of the changes that take place during the ripening process.

In these ripening changes several factors are to be taken into consideration—the production of acid, flavor, and aroma. These are dependent upon certain types of bacteria which are

common in milk and cream. The factors are also controlled by the temperature at which the ripening takes place. At the time of churning cream may contain enormous numbers of bacteria, often as many as 500,000,000 per c. c. (18 drops). The result of this germ development is the production of acid and the cream becomes sour. The best results are obtained from cream that is not overripe and does not contain undesirable flavors and odors due to the growth of undesirable organisms.

When milk or cream is hauled to the creamery in a fresh, sweet, cool condition the buttermaker has a comparatively few miscellaneous types of bacteria to deal with. He can usually control these by adding a starter. The starter is a selected culture of acid producing organisms that are known to produce the proper fermentations, and he is thus enabled to control the production of flavor and aroma and a high-grade butter is produced. If, however, the milk and cream are already too sour and an undesirable type of fermentation has developed, or if milk has been produced and handled under filthy conditions and surroundings, and there are all sorts of undesirable bacteria present, the conditions are unfavorable for the production of first-class butter.

By no means does all this trouble lie with the farmer and milk producer. Unless milk and cream are handled under clean and sanitary conditions during transit and at the creamery, the milk is sure to become filled with bacteria which are not desirable for the production of a high-grade product and certain types may be present which are liable to cause disease in the consumer. Furthermore the presence of undesirable bacteria accounts for untold losses each year to the dairy industry. It is also an advertisement of the fact that the producers or handlers are surrounded by unclean conditions, or are careless in handling their product.