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## Testing and Handling Dairy Products

C. Larsen

J.M. Fuller

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# AGRICULTURAL EXPERIMENT STATION

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SOUTH DAKOTA  
STATE COLLEGE OF AGRICULTURE  
AND MECHANIC ARTS

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DAIRY HUSBANDRY DEPARTMENT

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TESTING AND HANDLING DAIRY  
PRODUCTS

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BROOKINGS, SOUTH DAKOTA

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## TESTING AND HANDLING DAIRY PRODUCTS.

By C. Larsen and J. M. Fuller.

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### INTRODUCTION

During recent years there has been a widespread demand for information on the various phases of testing dairy products for per cent of butterfat. These requests have come chiefly from farmers who desire to know how to test the cream from their separators, and the milk from their cows for per cent of fat. The greatest demand for information along this line has perhaps come from the men who intend to operate, or are operating cream buying stations. These men for various reasons are seldom able to leave their regular business to take a course at the dairy school.

Patrons of creameries or of cream stations sometimes complain that they do not receive the same test for their cream from week to week. Not knowing the different factors that control the richness of cream from a hand separator, the patron concludes that the buttermaker or buyer does not know how to test, or that he is knowingly giving too low a test.

Consumers are more and more demanding quality in food products, and this is especially true of butter. The buttermaker must have the highest quality of cream if he is to produce first class butter.

This bulletin is intended to give in as simple a manner as possible information that will enable the farmer, buttermaker or cream buyer to test milk or cream correctly under South Dakota conditions. The factors that regulate the richness of cream from a hand separator are explained so that a farmer may know what to expect from his separator. The necessary details in producing a desirable quality of cream are set forth so that the farmer will know how to obtain first class cream.

## THE BABCOCK TEST FOR PER CENT OF FAT IN DAIRY PRODUCTS.

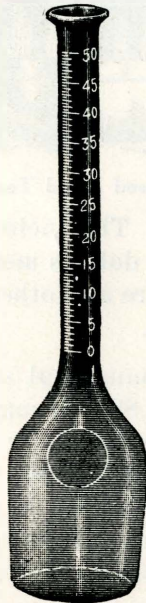
## General Principles and Description

To make a test, a certain amount of commercial sulphuric acid (specific gravity 1.82-1.83) and of milk or cream are mixed together. The sulphuric acid coagulates and digests the curd thus formed. Heat is generated by chemical action. This acid and milk or cream mixture appears as a hot, dark colored liquid. In such a condition the butterfat readily separates from the liquid. By whirling and by adding hot water, the fat is brought up into the neck of the test bottle to be measured.

## Chief Utensils and Glassware Used

Several kinds of glassware are used for the Babcock test. With a view of obtaining simplicity and uniformity, only one kind of cream bottle and one kind of milk bottle will be mentioned.

For testing cream, the 9 gram, 50 per cent bottle is deemed the most practical and is in most general use.

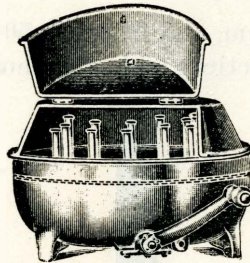


9 Gram 50 per cent Cream Bottle.

For testing milk, the ordinary 18 gram bottle having a graduated scale of 10 per cent, and with sub-divisions of 0.2 per cent, is perhaps the most practical for the average amateur tester to use.

A pipette graduated to 17.6 c. c. and delivering 18 grams of milk is a part of the glassware for testing milk.

A centrifugal machine or tester is one of the chief parts of a Babcock test outfit. There are three types of machines; viz., the inclosed hand tester, the open tester, and the steam tester. The latter is practical only where steam is at all times available. The open tester is cheap and is better than none, but it is not to be recommended. When the open tester is used in a cold room, the butterfat in the neck of the bottle is quite likely to congeal, thus interfering with the proper fat reading. Accidents are also more likely to hap-



Enclosed Hand Tester.

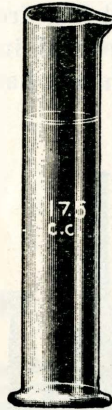
pen with such a tester. The inclosed hand tester can be purchased for just a few dollars more than the price of the open tester. The glassware and other supplies are the same for both types of testers.

The acid used is commercial sulphuric acid having a specific gravity of 1.82-1.83. It may be obtained from the different creamery supply houses or from the local druggist. Sulphuric acid is a violent poison, and great care should always be exercised in handling it, and in keeping it away from the reach of children. It should always be kept in a stoppered bottle, as it absorbs water from the air and thus becomes weakened.

An acid measure is also necessary. This is a small glass cylinder holding 17.5 c. c.

#### TESTING CREAM

One of the important steps in obtaining a correct test of cream is to mix it thoroughly before it is sampled. This can best be accomplished by pouring the cream from one can into another. If the cream is cold and stiff this may not be desirable, as a portion of it is likely to stick to the inside of the empty can. With the average thickness of cream, however, a thorough mixing can be obtained in this manner.



Acid Measure

In case cream is not mixed by pouring from one can into another, it should be very thoroughly stirred by using a regular cream stirrer. The stirring should be **very** complete before the cream is sampled, otherwise the mixture will not be uniform in richness.

#### Sampling

As soon as the operator, that is, the man who does the testing, is assured that the cream has been thoroughly mixed, a sample is taken and put into a bottle having a number marked on the outside. This number, together with the patron's name, should be written on a little memorandum slip so that in case the operator has several patrons'

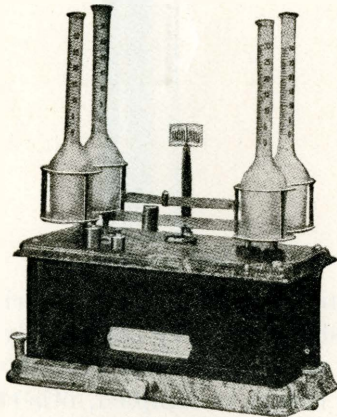


samples to test, he will know to whom each sample belongs.

Enough cream (about one-fourth pint) should be taken so that the operator can test the sample for acidity as well as for butterfat.

#### Weighing Sample for Fat Test

The next important step in testing cream is to weigh out the required amount and place it in a test bottle. Cream should never be measured with a pipette when the testing is done to fix a purchasing or selling value of the fat it contains; this is unlawful. The amount of cream weighed out is 9 grams. Great care should be taken to weigh cream on accurate and sensitive scales. Cream scales should at all times be kept clean and free from dust. Accurate weights should be used. In several instances weights that were either too light or too heavy have been found in cream stations.



Torsion Cream Scale.

The importance of keeping cream scales in first-class condition can not be emphasized too strongly. This applies especially to 12-bottle scales. For instance, two 12-bottle scales in fair condition were tested at the college experiment station. Cream was weighed into twelve bottles with these scales. By subsequent weighing on accurate laboratory scales it was found that instead of there being

9 grams of cream in each bottle there were anywhere from 8 to 10 grams. This would mean errors running as high as 3 per cent or 4 per cent, depending upon the richness of cream tested. Four-bottle and one-bottle scales proved to be quite accurate.

When the proper sample has been obtained, add 9 c. c. of warm soft water. Rinse down the cream in the neck of the bottle as the water is added. Mix thoroughly, then measure out about 15 c. c. of commercial sulphuric acid, add slowly, and turn the bottle as the acid is added, thus allowing the acid to rinse the inside of the neck of the bottle. Mix thoroughly by giving the bottle and contents a rotary motion, being careful that none of the curd gets into the neck of the bottle. The acid-cream mixture should have a dark chocolate color. Be sure to mix long enough. As long as there is scum or other impurity on the surface of the mixture the mixing should be continued.

The addition of water before adding acid makes surer a good test, especially in the hands of one who has previously done little or no testing. If acid is added in two or three portions, and mixing is done each time, a lighter, clearer fat column will result than if all the acid is added at once. For practical work, however, the acid is best added in one portion. The rotary motion should be used in shaking or mixing the contents of a bottle.

Some experience and judgment are necessary to enable the tester to add the proper amount of acid. The amount of acid varies according to:

First, the strength of the acid;

Second, the temperature of the acid and the milk.

The lower the temperature of the cream and of the acid, the more acid is needed. The temperature of the cream and acid should never be lower than fifty degrees Fahrenheit. If it is, the fat is likely to look white and tallowy. The best temperature for cream or milk and acid is around 70 degrees Fahrenheit. Acid standing in an open bottle or vessel becomes weak and it is then necessary to use more of it.

Does sour cream require more acid than sweet cream, and does rich cream require less acid than thin cream? These questions are sometimes asked by cream testers. A series of tests to secure evidence along these lines were run at the experiment station. It was found that for practical purposes the richness of cream does not affect the amount of acid required. Sour and sweet cream do not require different amounts of acid.

The strength of the commercial sulphuric acid as purchased from supply houses may vary. If more than about 15 c. c. of acid has to be added to a 9 gram sample of cream of proper temperature (when water has been added first), it indicates that the acid is weaker than it should be. During the past year several carboys of acid were tested at the station. Two of the 5 gallon carboys contained acid considerably weaker than it should have been as it was necessary to use about 50 per cent more of the acid than usual.

### Centrifuging

The next important step in testing is to centrifuge the samples. The bottles should be put in the testing machine opposite each other, so that one balances the other. It should be remembered that a very small difference in the weight of opposite bottles makes a big difference when the machine is run at full speed. These samples should be whirled at full speed, according to directions, for five minutes. Then the machine is stopped and the boiling hot, soft water is added to the samples until the mixture comes up to the bottom of the neck of the bottles. If impurities show in the fat at the lower part of the column, the sample may be gently rotated so as to mix this fat with the hot water added. This will usually wash the fat away from the other impurities, and then on whirling in the machine the impurities will separate entirely from the fat. Next whirl two minutes more. If the room is cold and there is danger of the fat chilling, one minute at full speed will do. Then add boiling hot, soft water until the fat comes up in the

neck above zero and below the 50 mark. The hot water should be dropped so as to percolate through the fat column. This tends to wash out the impurities in the butterfat. Then again whirl the bottles a few revolutions at full speed. One minute is usually given as the proper length of time, but with a hand tester it is not advisable to whirl very long as the fat is likely to get cold.

### Reading the Fat Column

If the test has been properly made the fat is in the neck of the bottle as a pure oil having a golden yellow color. If it is dark in color, too much acid has been used. If it is light with some white curd at the bottom, not enough acid has been used.

The bottles are immediately taken out of the tester and put into a hot water bath until the fat is thoroughly liquified. The water should come as high as the top of the fat column. The temperature of the water should be from 130 to 140 degrees Fahrenheit. It is not so important to temper the fat in a water bath during the warm season of the year, but during the cold season the bottles should be put into the water bath as mentioned above.

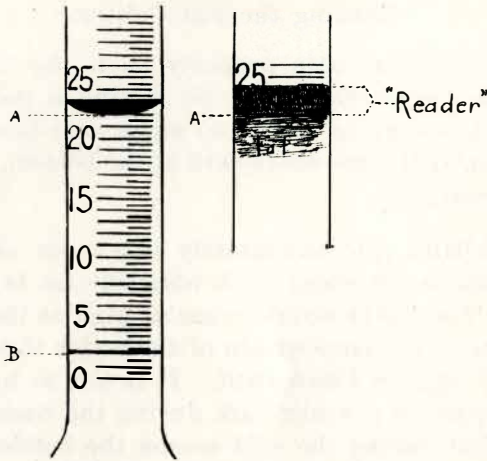
If the testing and sampling have been accurately done, there should be no occasion for complaint on the part of the patrons nor on the part of the creameries. There are, however, just a few common difficulties in getting the proper reading of the test:

First. The fat is dark, and dark matter appears at the bottom of the fat column. This is due to too much acid, too strong acid, too high temperature of cream and of acid, and allowing the acid to remain in contact with the cream too long before mixing.

Second. Too light color of butterfat and white curdy material at the bottom of the fat column. This is due to too weak acid, not enough acid, too low temperature of

cream and acid, and, in some instances, to insufficient mixing.

Third. Impure foam on the top of the fat column. This is due chiefly to the use of hard water instead of soft water. Minerals in the hard water combine with the sulphuric acid and cause gas bubbles to rise to the surface. This may to some extent be overcome by adding a few drops of "red top", or saturated alcohol solution.



Cream Testing. Measure from bottom of fat column to bottom of meniscus or from A to B. Second drawing shows how the use of a "reader" levels top of fat column.

In reading the fat column a pair of dividers should be used to prevent mistakes. The reading should be taken from the extreme bottom of the fat column to the bottom of the curvature at the top. If the fat column is clear, the lower side of curve in the top of fat column can readily be seen. Clear tests are not always secured and in such case it may be difficult to secure an accurate reading. The use of a few drops of "red top" will so level the top of the fat column that a good reading can be secured.

Red top should be used in all cases where cream is tested for commercial purposes, as in the case of creameries or cream stations. Red top may be purchased from sup-

ply houses or it may be made by coloring an oil, like white mineral oil or paraffine oil, with a red coloring matter. If an ounce of alkanet root is put in a small muslin bag and suspended for 48 hours in a quart of one of the oils mentioned, an excellent red top will be secured.

In case of the farmer who does but little testing, a few drops of sewing machine oil or high grade separator oil may be used to level the top of the fat column.

Red top or any "reader" should never be used in reading milk tests.

### Testing Cream by Farmers

Under most farm conditions, it is probably not advisable to weigh out the samples of cream, thus requiring delicate scales. The farmer as a rule desires only approximately correct tests. For instance, he tests his cream chiefly to find out how rich cream the separator is skimming and to check the tests of the creamery or the man buying his cream.

Sufficiently accurate results for these purposes may be obtained by measuring out 9 c. c. of cream into a cream bottle by the use of a 9 c. c. pipette. Sweet cream should be used. Have the cream and acid at about room temperature, or from 70 to 75 degrees Fahrenheit. Measure out 9 c. c. of cream into bottle. Fill pipette to mark with warm soft water and allow water to run into test bottle. Turn bottle so as to rinse down cream and also rinse the pipette so no cream is left in the pipette. The pipette should be rinsed with clean, cool water before being used again.

The chief reason why cream cannot be measured out and an accurate sample secured, is that a given volume of cream does not always weigh the same. The weight of a given volume of cream depends upon the per cent of fat, the amount of air or foam it contains, and the amount that adheres to the pipette.

Measure out the sample of cream, add the acid and complete the test as previously described. When the test is read, correct the reading in accordance with the following table, worked out in the laboratory of this station during the past year:

Per cent cream obtained by pipette method.	Correction to be added.
24 per cent or less . . . . .	.0 per cent
25-29 per cent inclusive . . . . .	.5 per cent
30-34 per cent inclusive . . . . .	1.0 per cent
35-39 per cent inclusive . . . . .	1.5 per cent
40-45 per cent inclusive . . . . .	2.0 per cent
46-49 per cent inclusive . . . . .	2.5 per cent
50-54 per cent inclusive . . . . .	3.0 per cent
55-58 per cent inclusive . . . . .	3.5 per cent
59-60 per cent inclusive . . . . .	4.0 per cent

For example, if a test of 50 per cent is obtained, then the corrected test will be 53 per cent; if a test of 38 per cent is obtained, the corrected test is 39.5 per cent.

#### TESTING MILK

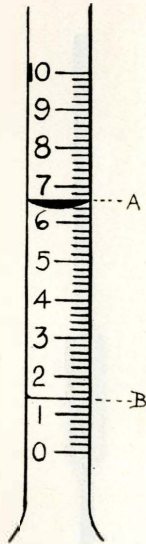
The testing of milk is carried on in a manner similar to the testing of cream. The Babcock test is based on taking as a sample 18 grams of the product to be tested. In testing milk the full sample is always measured into the testing bottle. With milk of average richness a 17.6 c. c. pipette delivers 18 grams.



**Pipette for Milk Testing.**

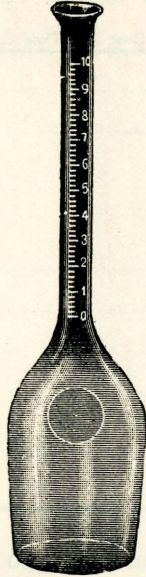
Before the sample is measured into the testing bottle the person doing the testing should be sure that the milk from which the sample was taken was well mixed and that milk of average richness was secured.





Milk Testing. Read from bottom of fat column to top of column, or from A to B.

The amount of acid to use depends on the same factors already mentioned under "Testing of Cream." A full measure or 17.5 c. c. of acid usually is not too much. Mix acid and milk thoroughly, whirl and complete test as already described under cream.



10 per cent Milk Bottle

The milk test should be read from the top of the meniscus or curvature to the bottom of the fat column. Reading should be done before the fat gets cold and hardens. In cold weather the bottles should be set in a hot water bath as described under cream testing. The temperature of water should be from 120 to 130 degrees Fahrenheit.

#### Weighing Milk From Cows

It is important for every farmer to know what each cow in his herd produces. To ascertain this the milk produced by each cow should be weighed. This can easily be accomplished by placing a pair of spring scales in a convenient place near the milk room. The weight should be marked down on a sheet of paper kept for this special purpose.

Such a record sheet may be ruled and made up at home or special sheets of paper already printed may be purchased. These latter are cheap and handy. One form of ruling these sheets is as follows:

## Milk record Sheet for Month of.....19...

		Cow A.	Cow B.	Cow C.	Cow D.	Cow E.	Etc.
Nov. 1	A. M.						
	P. M.						
Nov. 2	A. M.						
	P. M.						
Nov. 30	A. M.						
	P. M.						
Total Lbs.							
Per cent fat							
Lbs. of fat							

At the end of the month the pounds of milk produced by each cow should be added, and the total marked at the bottom of the milk sheet. The amount of milk alone is not a sufficient indication of what each cow produces. Some cows give milk rich in butterfat, while others produce thin milk. A cow giving a large flow of thin milk may be a more profitable cow than one giving a small quantity of rich milk. Quantity of milk, and quality of milk as indicated by the Babcock test, must both be considered in determining the producing ability of a dairy cow.

## Testing Milk From Different Cows in the Herd

It is not necessary in getting approximate results to test a sample of milk from each milking. This is done in official testing where the exact amount of milk and butterfat is desirable. Such a method would involve too much labor and too much expense for the average dairy farmer.

Experiments show that if the milk from a cow is sampled and tested two days out of each month and the production for a month calculated from these figures, the re-

sults will be within about 98 per cent of her actual production. This is sufficiently close.

Secure as many one-half pint bottles with covers as there are cows in the herd. Number or name each bottle to correspond with the number or name of a cow. Put a small amount of preservative into each bottle. Corrosive sublimate tablets are on the market for this purpose. Put one tablet into each bottle.

Then during two days out of each month take a small sample from each milking and put it into the bottle corresponding to the number or name of the cow milked. A sampling tube or "milk thief" should be used for this purpose, so as to secure a sample proportionate to the amount produced by the cow, and to facilitate getting a sample of average quality. When a sample is added to the composite jar, gently rotate it so as to mix the preservative with the milk. Be careful to keep these composite samples covered until they are tested for fat.

The tests of these two-day composite samples represent the average per cent of fat of the milk produced by each cow during that month. In some instances the sampling covers only one day out of each month. The two days sampling, however, is the most accurate.

The per cent of fat should be posted on the month's record sheet and multiplied by the pounds of milk. The product represents the pounds of butterfat produced per month by each cow in the herd.

At the end of the year, the farmer, by means of these records, is able to locate his poor producing cows, and also his most profitable cows. The poor ones can be disposed of at any desirable time. The heifer calves from the best cows can be saved to form the future herd.

#### Cow Test Association

The importance of weighing and testing the milk from

each cow in the dairy herd is great, but farmers often think it too much trouble. In such instances a number of neighboring farmers thus interested may form an association, and hire a man to do the work of testing the cows in the different herds.

About twenty-five different farmers may belong to one association. The man hired to test the cows goes from one place to another, does the testing, and makes out the monthly report. In this manner the cost of getting the cows tested is from about one to two dollars per cow. Cow test associations originated in Denmark and have been put in successful practice in different parts of the United States. The first cow test association in South Dakota was organized at St. Onge, and began to operate May 1, 1914.

Several other forms of co-operation among farmers, such as the purchase and exchange of dairy sires for improving the production of the herds, and the exchange, sale and purchase of the different kinds of farm products, can be carried out within such a cow testing association.

Representatives of the State Agricultural College and Experiment Station are at all times ready to aid in the organization of this or any other form of co-operation for the farmers' interests.

#### TESTING CREAM FOR ACIDITY ●R●OURNESS

Generally speaking, sour cream means old cream. Sour cream also means that it has been kept at too warm a temperature. Old and sour cream do not make good butter. Cream intended for good butter should therefore not be sour and old.

In order to ascertain the market value of cream it is not enough to find out the per cent of fat it contains. The per cent of acid or sourness of cream should also be determined. The value of cream should be based both on per cent of fat and of acid, and on its general quality.

### Manner of Testing

The acid test consists of an alkaline solution made up from Farrington's alkaline tablets. One tablet is used in one ounce of soft water. Allow the tablets to be thoroughly dissolved. A small dipper having a capacity of about twenty cubic centimeters, (equal to nearly three teaspoonsful) is used for measuring out the cream. Rinse all cream from inside of the measure and add rinsing to sample to be tested. The same dipper is then used for measuring out the alkaline solution. (Avoid having cream on the outside of the dipper). One dipper of the solution is added to the cream in an ordinary white cup and thoroughly mixed. More solution is added and mixed, one dipper at a time, until a permanent pink color is secured. This shows that all of the acid (sourness) in the cream has been neutralized by the alkaline solution. Each dipper of solution added represents one-tenth per cent of acidity in the cream; hence, if six dippers of solution were required to obtain the pink color the acidity of the cream would be six-tenths per cent, or about 35 degrees Mann's acid test.

*Cream containing more than six-tenths per cent of acidity is condemned by law.* Cream having less than three-tenths per cent acidity and having no bad odor or flavor is considered first grade cream. Cream having more than three-tenths per cent of acidity with not as good a flavor as required for first grade, is considered second grade.

If more alkaline solution is made up than is used each day, the container should be corked or sealed to prevent evaporation and contact with the air. Otherwise it will not be of normal strength.

### CARE OF THE CREAM SEPARATOR

It is important to give attention to the care of the cream separator for the following reasons:

First: The separator may have considerable influence upon the quality of cream, from a sanitary view point.

**Second:** The life and efficiency of a separator depend largely upon the care it receives.

**Third:** The manner in which a separator is run has a great influence upon the richness of cream separated and the amount of fat that is lost in the skim milk.

#### Location of Separator

The best place for a separator is in a room that can be kept free from dust and foreign odors. Such conditions can best be secured by building a small milk house or providing a special room. When dairying is the main business on a farm, then a milk house should be provided.

Just where the separator shall be located is a matter that must be decided according to conditions on each farm. Few barns are free enough from odors, or have a room sufficiently free from dust to permit the separator being kept in such a building. Milk and cream absorb odors very easily; hence the reason for a room free from odors. Dust contains bacteria, and bacteria cause milk and cream to sour and spoil. Some keep the separator in the kitchen. If the milk is separated at a time when no foreign odors are present, and when the room is free from dust, there is no objection to keeping the separator in such a place.

#### Washing the Separator

A separator should be washed every time after it is used. More or less milk impurities are found in the bowl after every separation. If the bowl is not washed, enormous numbers of bacteria will grow in the slime, and when the separator is used again the milk and cream will be contaminated with great numbers of germs. Buttermakers can sometimes locate dirty separators by the quality of cream that a patron delivers. Some users of separators think that the machine has been washed if a gallon or two of water is run through after the milk is separated. This may remove most of the milk and cream but it will not make a clean separator.

Flushing to remove all cream from the bowl may be done with skimmilk or with cold or luke warm water. Then about a gallon of clean luke-warm water may be run through the separator to remove milk from supply tank, bowl, and milk and cream discharge pipes. Hot water should never be used at this time, since it will very likely set the albumen of the milk on the parts of the separator, making them difficult to wash. The bowl should be taken apart and discs and bowl parts washed in luke warm water to which a little washing powder has been added. Soap should never be used. A brush is preferable to a cloth since it is easier to keep clean. The tank and cream and milk discharge pipes should receive the same treatment as the bowl. Rinse all parts in boiling water and put to drain and dry in a place free from dust. No wiping will be necessary. The bowl should not be assembled, but left so the air can get to each piece or disc. If drying can be done in the sun, so much the better as direct sunlight kills germs.

### Operation

The bowl of a cream separator may run from 6,000 to 10,000 or 12,000 revolutions per minute depending upon the diameter of the bowl and upon the make. This fact alone should be sufficient to warn the operator that a separator, if it is to have a reasonably long life and do its work well, should receive good care and be run properly. A solid, level foundation should be provided. In placing a separator, a level should be used to make sure that the machine is setting as it should. Kerosene can be used to cut any dirt or gum that may accumulate on the bearings. An ample supply of high grade oil will lengthen the life of a separator and make for greater ease of running. Be sure that the different parts are properly assembled. If the bowl wobbles when starting, do not increase speed as a wobbly bowl run at full speed is likely to spring spindle or injure the bushings. The machine should be stopped and the trouble remedied.



## WHY THE CREAM TEST VARIES

Should the man who sells his cream to a creamery or to a cream station expect the cream to test the same from week to week? Many argue that since the milk that is separated comes from the same number of cows, with feed the same, the milk the same, the same separator and with the same man running the separator, the cream should show the same tests from day to day or week to week. If the test varies, the honesty or ability of the creamery man or cream buyer is questioned and a dissatisfied patron may result. Several factors govern the richness of cream delivered by a separator and unless these factors are kept the same from day to day, then the machine will not deliver cream of the same test. Following are the main factors that cause a variation in the cream test.

## Regulation of Cream Screw

In nearly all makes of separators the cream screw can be so adjudged as to cause the machine to deliver cream of varying richness. When turned in or towards the center, richer cream will be delivered; when turned out or away from the center, thinner cream will result. When the other factors are regulated properly, the cream screw should be set to deliver cream testing from 30 to 35 per cent in winter and 35 to 40 per cent in summer.

## Speed

The speed at which a separator is run has a great influence on the richness of the cream delivered. The speed at which a separator should be run is marked on the crank handle. If the bowl revolves 6000 times per minute and the crank turns 50 times to produce this speed, then each turn of the crank means 120 revolutions of the bowl. Ten turns a minute more or less than the required 50 mean 1,200 revolutions of the bowl more or less than is intended. The manufacturer has determined the proper speed for his separator and the operator should be careful to turn

the crank at that speed. By using a watch, the operator can soon learn to turn at the right speed.

Cream testing as low as 10 per cent or as high as 60 per cent may be obtained merely by variation in speed. If normal speed is 55 turns per minute, around 75 turns will bring rich cream and around 25 will bring thin cream. A great deal of fat is lost in the skim milk when low speed is used. Sometimes nearly one-half of the fat in the whole milk may be found in the skim milk, in case the separator has been turned at too low a speed. This fact should be enough to convince one that the right speed should be used.

### Inflow of Milk

The amount of milk-flow from the milk tank into the separator bowl can influence the richness of cream to quite an extent.

The amount of skim milk that comes from the skim-milk outlet is limited by the size of the outlet. If too much milk is allowed to run into the bowl, then some of the skim milk must necessarily escape with the cream thus making the cream thinner. If the amount of milk that flows into the bowl decreases, then less skim milk will escape from the cream outlet and the cream will be richer. When the inflow is large more fat will be lost in the skim milk than when the inflow is normal. When the inflow is large less time is required to separate a given amount of milk than when the inflow is normal or small. Cream testing as high as 60 or 70 per cent may be obtained with a small inflow. If normal inflow gives cream testing around 35 per cent, then a large inflow may give cream testing as low as 20 or 25 per cent.

The rate of inflow is governed by the float. Many people discard the float thinking it of no importance. When cream varies in richness from 25 or 30 per cent to 60 per cent merely by varying the rate of inflow, then it can

readily be seen that the float is really an important device and that it should be used as intended. The supply tank should also contain plenty of milk so as to admit a uniform flow.

### Richness of Milk

The richer the milk the richer the cream that will be separated from it. For instance, if 20 per cent cream is separated from 3 per cent milk, then cream testing around 40 per cent may be expected from 6 per cent milk. The per cent of fat in milk from a large herd will not ordinarily vary from day to day. If the herd is small the per cent of fat in the milk may increase or decrease noticeably in a few days, due for instance to drying up of certain cows or to other cows freshening. Cows freshening in the spring will give the richest milk in the fall and winter. This is due to the fact that they are advanced in the milking or lactation period, and to the fact that under average farm conditions they are on dry feed.

### Temperature of Milk

The proper temperature at which milk should be separated is as close to the body temperature of the cow as is possible or around 90 degrees Fahrenheit. If separation is done immediately after each milking, it will be found that the temperature of the milk is around 90. Less fat is lost in the skim milk when separation is done at this time. Then, too, milk in such condition is better than cold milk for calves and pigs. Milk separated at 90 will produce thinner cream than milk separated at 50 or 60. Some separators may even clog if the milk is too cold. In such a case the cream from the milk will be thicker than from the warmer milk. The loss of fat in the skim milk will run high when milk is separated at too low a temperature.

### Amount of Flush Water

The amount of water or skim milk used to flush the bowl influences the richness of cream, though under average conditions not to the same extent as do the factors

already given. When cream begins to appear watery it shows that enough flush water has been used. The float should govern the flow of flush water into bowl.

### Smoothness of Running

A solid, level foundation, steadiness of running, and proper oiling add to the life of a separator. They mean reduced vibration of the bowl and this means more satisfactory and uniform skimming. More fat is lost in the skim milk when the bowl does not run smoothly than when it runs as it should.

If more than around .05 per cent fat is lost in the skim milk, then something is wrong with the separator or else it is not being run properly.

### PRODUCTION OF A HIGH QUALITY OF CREAM

In the production, sale and manufacture of dairy products the mass of consumers of these daily necessities are vitally interested. They have a right to expect and even demand dairy products from healthy cows, handled under sanitary conditions, and manufactured from fresh raw material into the highest quality of finished products. The consumers are daily demonstrating that they are willing to pay even a fancy price, providing they can be assured that the quality is absolutely right.

Some of those who handle dairy products, especially the raw products, do not realize that milk, butter, and cream are very perishable articles. As a consequence, the whole dairy industry has suffered from ignorance of these parties.

With a view of protecting the consumers and helping the producers, buyers and manufacturers of dairy products, the state of South Dakota has enacted adequate dairy laws. The following is an extract from the South Dakota Dairy Laws, pertaining to cream:

“Chapter 296, Section 5. (Cream For Butter Making Purposes—When Unmerchantable). For the purpose of this act, cream shall be deemed unmerchantable for butter making purposes:

“1. If it be in an unclean, filthy or unwholesome condition.

“2. If it be cream from milk which was in a filthy, unclean or unwholesome condition.

“3. If it be cream from milk produced from animals having disease, sickness, ulcers, abscess or running sores, or from milk which has been taken from the animal within fifteen days before or five days after parturition; or from milk which is produced from cows kept in an unwholesome place, or which have been fed undesirable foods in a state of putrefaction or rottenness, or of an unhealthful nature.

“4. If at any time it be contained in a filthy, unclean, unsanitary or unwashed vessel, can, pail or other container.

“5. If it be cream from milk which at any time has been contained in a filthy, unclean, unsanitary or unwashed vessel, can, pail or other container.

“6. If it be cream which has been skimmed by a filthy, unclean, unsanitary or unwashed separator.

“7. If it contain less than 20 per cent butterfat.

“8. If it has an acidity exceeding 35 degrees, Mann’s test.

“9. If it is above 70 degrees Fahrenheit in temperature.

“10. If it contains any artificial preservatives.”

With the close observance and strict enforcement of the foregoing, plus moral law and good will of the dairy and creamery men, great improvements should be accomplished.

The following suggestions should be carefully considered:

### Healthful and Clean Milk

1. Only milk from healthy cows should be used. Milk from an inflamed udder or teat should be discarded. Do not use milk until five days after freshening.

2. The barn in which the cows are kept should be clean, free from bad odors and well ventilated. Feeding hay to cows should not be permitted just previous to milking, as it will cause much dust in the air. This dust contains multitudes of germs, which in turn contaminate the milk and utensils. Neither should sweeping the floor or cleaning the stable be permitted just before milking, as this causes dust and bad odors to saturate the air. Milk and cream quickly absorb these undesirable taints. Open the barn doors during the day while the cows are out, so as to air out the barn well.

3. Wipe off the cow's udders and flanks with a damp cloth just before milking. This removes loose particles and dust which otherwise would fall into the pail. Dirt of all kinds always contains germs. It is the germs which cause milk, cream and dairy products to sour and deteriorate. Therefore, to keep germs out of milk and cream as much as possible, see that no dirt enters the milk or utensils.

4. The milk should be skimmed at once after milking and while still warm. If allowed to cool, the separator is likely to clog, and too much fat is lost in the skim milk, and the cold skim milk when fed to the calves is likely to cause scours and indigestion. During the cold weather, pour a little hot water into the separator just before separation. This warms the separator parts, thereby preventing clogging and obtaining close skimming at once.

5. Strain the milk through a wire gauze strainer before separation. If flies bother, tie a piece of cheese-cloth over the top of the separator supply can.

6. All the utensils must be kept clean, dry and sweet. The cream can, milk pails and separator should be cleaned at once after using to prevent decomposition of the milk. If allowed to stand without being cleaned, they soon become saturated with foul odors and undesirable germs. Wash them in warm water containing some washing powder or sal soda. Use a brush for cleaning rather than a cloth. Then rinse in scalding hot water, and put them away to drain and dry outside on a lath bench, mouth down. The heat imparted to the tin will soon dry them, and the bright sun will destroy the germs. When tin utensils are treated in this way they do not rust. Rusty cream cans must never be used.

#### Cooling Cream Very Essential

7. Cool the cream at once after separation. This can be done by placing the cream can in a tank of fresh, cold water. A good plan is to have the water used for stock run through this milk cooler before it reaches the general water tank. This method cools the cream during all seasons, and in addition it prevents freezing during the winter. Do not put the can cover on tightly. A loose cover allows the animal odor to pass off, and at the same time prevents dust from getting into the cream.

8. Never allow freshly skimmed warm cream to be mixed with the previously skimmed cold cream until the former has been well cooled. The warm cream causes the germs to develop, and they sour and spoil the cream.

#### Old Cream is Bad

9. Deliver the sweet cream as often as possible, at

least three times a week in the summer, and twice per week during the winter.

10. Wrap a heavy blanket around the can to keep the cream from freezing on the road to the creamery or cream station. During the summer and warm weather soak this blanket in cold water to keep the cream cold.

### General

If the above simple points are observed, an improved quality of cream and butter will be obtained. A higher price will be secured from the consumers of the finished products, and therefore a higher price paid to the cream producers.

To obtain improved quality of products in the dairy industry, the producers of the raw material, and manufacturers of the finished products must co-operate to a greater extent than perhaps is necessary in any other phase of agriculture. If the cream producers fail to do their part, the manufacturers fail. No one can manufacture good butter from old stale cream. If a good quality of fresh cream is produced, the dairy farmers have a right to expect and even demand the highest possible market price. By producing fresher and better cream, the quality of butter can be improved so that it will sell on the large butter markets in competition with butter from other states at a higher price, and the demand for it will be increased. By paying close attention to quality, the profits from the dairy industry in the state of South Dakota can be increased by several hundred thousand dollars, and at the same time add to its favorable reputation.

The dairy farmers are at the foundation. They can do more for the improvement of the raw dairy products



than any others, but to get maximum improvements, concerted co-operation between the producers and manufacturers is necessary.

Sanitary surroundings at places where cream is produced and handled, keeping the milk and cream cold, and getting the cream to the factory while it is fresh, are three essentials to keep in mind to improve present quality of finished dairy products.