

# Experiment Station

of the

## Kansas State Agricultural College

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*Dairy Husbandry Department.*  
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### ***Grading Cream.***

The future development of the dairy industry in Kansas depends upon the profit of the dairy business, which is governed entirely by two factors; first, the cost of production of dairy products; second, the price received for them. While the first factor plays an important part in the dairy business, it is the second factor that is desired to be considered in this treatise.

The second factor depends entirely upon the demand and supply, and this again depends upon the quality of the article which affects the consumption. To show the significance of this statement, a test was made in which good second-grade butter was supplied on the tables of a series of boarding-houses. Without bringing the attention of the boarders to the fact, the butter was changed to fresh butter, classed as first grade. The consumption was immediately increased approximately 33 per cent, and if a still poorer quality than second-grade butter had been furnished, the variation in the amount consumed would have been much greater. Since this publication is to take up only one phase of the dairy industry, namely, the butter side, it is our intention to make clear the great importance of the relation that the quality of the butter bears to its consumption.

Great progress has been made in dairying within the past few years, and, although it has become quite necessary to introduce dairy methods in Kansas in order that the fertility of the soil may be maintained, and to establish more permanent and prosperous conditions, it was found that the creamery and dairy methods employed in the East were not suited to the conditions in Kansas. Owing to the many localities in Kansas which are sparsely settled,

it involved a great expense to transport milk, on account of its bulky nature, to a central point, such as is still done in the East. To overcome this objection in these localities and to bring about conditions which permitted the average farmer to sell his cream on an open market, the same as he does grains and other farm products, it became necessary to introduce what is now called the hand separator system, by which every farmer who purchased one of these cream separators could skim his milk, feed the skim-milk to farm animals, store his cream for several days, and finally haul the product to the creamery or station to be sold to some creamery where it is ultimately made into butter. These circumstances brought on conditions which were quite unfavorable for the production of first-class butter. These conditions came about in the following manner:

First, owing to the fact that the farmers were not accustomed to operating the hand separator and keeping it in a perfectly sanitary condition, which is so essential in the art of dairying. Thus at times milk was run through filthy separators which tainted the cream and started a serious fermentation.

Second, since it is the milk sugar and casein which are the chief constituents of skim-milk that are most fermentable, and since cream consists merely of butter fat and skim-milk, it would under all conditions be more profitable for the farmer to remove and retain as much of the skim-milk as possible, which would reduce the weight or volume and thus lessen the transportation expense. But the importance of regulating the cream separator was not recognized, and a great deal of thin cream was shipped, which made conditions more favorable for the development of taints and bad flavors in cream.

Third, cream produced under these conditions was kept for a long time before it was delivered. On the average Kansas farm very few appliances are at hand to cool the cream, and under ordinary temperatures, such as we would expect to find on a farm, it would not require more than two days to set up a fermentation in the cream which would develop a sourness sufficient to make it ripe enough to churn. Hence, it can be stated without further explanation that cream kept for a week or two becomes overripe and, in a certain sense of the word, decayed.

Fourth, long distances of transportation and the lack of cooling facilities on the train were still more conducive to the furthering of the fermentation. Out of such a product the butter maker could do little to restore the quality, and to make an extra butter out of this cream would be impossible.

Fifth, with this method of handling cream fierce competition began. Any cream, no matter how old or how rancid, had a market at the creameries at the same price per pound of butter fat as that paid for first-grade cream. According to this method the man who was neat and clean in his operations and handled his cream under the most sanitary conditions, received the same money as the man who paid no attention to the quality of his cream. Hence, there was a constant tendency for the dairymen of Kansas to produce cream of a poor quality.

Sixth, owing to this unhealthy competition the price of butter fat was enhanced and the creamerymen were obliged to resort to methods which would tend to increase the overrun of the butter in order that they might have a fair margin of profit. The overrun, in short, is the difference between the butter fat and the butter. It consists chiefly of water and salt, with a small amount of casein, milk sugar, and ash. By increasing the overrun, water is incorporated in the butter, which naturally results in reducing the quality of the butter if more than 16 or 18 per cent is incorporated.

#### THE GRADING OF BUTTER.

The great markets of the United States score butter under the following plan:

Flavor .....	45
Body .....	25
Color .....	15
Salt .....	10
Package .....	5

#### FLAVOR.

The value of butter over grease depends largely upon flavor and aroma. To make a good flavored butter we must have good milk to begin with. The principal defects in flavor can be classed under four heads:

1. Rancid flavor.
2. Tainted flavor.
3. High acid flavor.
4. Low acid flavor.

The cause of rancidity in fresh butter is due:

1. To old milk or old cream.
2. To unsanitary conditions by using filthy utensils and apparatus.
3. To a poor, loose body containing large quantities of casein, which, when contaminated and kept at a warm temperature for a short time, develops rancid acid very quickly.

Tainted flavor in butter is caused :

1. From tainted milk or cream.
2. From the impure water with which it is washed.
3. Unclean or badly flavored salt.

4. By the use of unclean utensils, such as churn, worker, ladle, packing boxes, etc.
5. By storing in places where odors are strong from filth of foreign substances placed around it.

The high acid flavor is due:

To cream being held at too high a temperature for too long a time.

A low acid flavor is due:

To cream being held at too low a temperature for too short a time.

If the flavor of butter is perfect, the value of it as given in the card is 45 points.

#### BODY.

The body of the butter should have a granular, yellow, amber appearance. The cause for the difference in appearance in texture between butter and grease is due to the amount of water incorporated in butter. There should be approximately 16 per cent of water in butter—not less than 12 per cent and not more than 17 per cent.

The defects in the body of butter may be divided into six classes:

1. Too much water.
2. Greasy.
3. Oily.
4. Tallowy.
5. Cheesy.
6. Milky body.

Too much water is due:

1. To insufficient working.
2. Working butter too cold or too warm.
3. Washing butter with warm wash water when churned at a low temperature.

Greasy butter is due:

1. Butter handled or worked too much.
2. Churned in unwashed or unscalded churn, worked on unscalded workers, and handled with unscalded ladies.
3. Butter worked below fifty degrees assumes a greasy appearance.
4. Butter worked at too high a temperature assumes a similar appearance.

Oily butter is due:

1. Soft, succulent feeds, gluten feeds, or oil-meal.
2. To a specific fermentation.
3. By heating the cream to near the boiling point when pasteurizing.

Tallowy butter is due:

1. To improper feeding: for instance, too much cottonseed-meal or bran in proportion to other feed.
2. To a lactic fermentation.

Cheesy butter is due:

1. To the curdling of cream, either sweet or sour.
2. To a milky body.

A milky body is due:

1. Buttermilk not separated from butter, or butter not thoroughly washed.
2. Butter made fromropy cream.

The body of butter if perfect counts 25 points.

COLOR.

The color of butter should be a light straw, and the defects in color may be classed as follows:

1. Too yellow.
2. Too light.
3. Mottled.
4. Specked.
5. Streaky and wavy.

Too yellow butter is due:

To the use of too much coloring matter.

Too light is due:

To insufficient coloring matter.

Mottled and streaky is caused:

1. By developing a high acid in cream or starter and the incorporation of the froth of the cream.
2. By improper separation.
3. Change of temperature.
4. Sudden chilling before salt is dissolved.
5. Insufficient working.
6. Uneven distribution of salt.

Specked butter is due:

1. To overripe cream.
2. To dried cream.
3. To foreign matter.

Color, if perfect, counts for 15 points.

SALT.

The salting of butter depends largely upon the demands of the market. However, butter may be:

1. Excessively salted.
2. Not salted enough.
3. Gritty.

Gritty salting is due to salt being to hard or not giving salt time enough to dissolve.

Salt counts 10 if perfect.

BUTTER PACKAGE.

Neatness of package has much to do with the increased consumption of butter. Butter, if put up in prints, should be wrapped in parchment paper to preserve it. Prints should be

rectangular and have a neat, trim appearance. Whatever may be the condition, the man that puts his butter up in the handsomest packages will sell the most butter if other conditions are equal.

The value of package, if perfect, counts 5.

Butter being first scored, is then graded into extras, firsts, seconds, and thirds. The rules governing the grading of extras are that they shall consist of high-grade butter produced during the season, scoring not less than 93 points. The following are the requirements of extras:

1. *Flavor.*—Must be fine, fresh and clean if of fresh make, and good, sweet and clean if held in storage.
2. *Body.*—Must be firm and solid, with a perfect grain or texture, free from salvinness.
3. *Color.*—Must be uniform, neither too light nor too high.
4. *Salt.*—Well dissolved, thoroughly worked in, not too high nor too light.
5. *Package.*—Good and sound, as required in classification.

#### *Firsts.*

Firsts shall be a grade just below extras, scoring 87 points or higher, lacking somewhat in flavor, which, however, must be good, sweet, and clean. All other requirements are the same as in extras.

#### *Seconds.*

Seconds shall consist of a grade just below firsts, scoring not less than 80 points.

*Flavor.*—Must be fairly good and sweet.

*Body.*—Must be sound and smooth boring.

*Color.*—Fairly good, although it may be somewhat irregular.

*Salt.*—May be irregular, high or light salted.

*Package.*—Same as required in firsts.

#### *Thirds.*

Thirds shall consist of butter below seconds, scoring not less than 75.

*Flavor.*--Reasonably good, may show strong tops and sides.

*Body.*—Not smooth boring.

*Color.*—Mixed or streaked.

*Salt.*--Irregular.

*Package.*—Miscellaneous.

#### RANGE OF PRICE.

As a rule, extras sell from one to four cents higher than firsts, depending somewhat on the supply, but the supply is never equal to the demand. Firsts sell from two to three cents higher than seconds, and seconds sell proportionately higher than thirds, but the demand is seldom equal to the supply. Since there is such a range in the market price of butter of the first and second grades, there should be a similar range between the first and second grade

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of cream, for it, requires as great an effort to produce first-grade cream as to produce first-grade butter.

According to the score-card, the flavor of butter is valued highest, and since the flavor of the butter depends on the quality of cream received there should be a difference of at least four cents, and more legitimately a difference of five cents, between the first and second grades of cream. Likewise there should be a difference of not less than two, and more legitimately three, cents between the second and third grades.

Good flavor can only be produced by the proper fermentation, which requires a pure cream, hence the precautions that are necessary in handling cream to secure a good-flavored butter must begin from the time the milk is drawn. Any taint incorporated in the cream will follow the butter through all its stages of manufacture and onto the market, where it is discovered and a correspondingly lower price is paid for it. From this we see that the care of the cream while in the producers hands will have a marked influence on the ultimate value of the butter.

The body of the butter can be governed largely by temperature, hence it is chiefly within the butter maker's power to regulate this one point, which is also true of the color, salt, and package. The producer is held responsible for one point only, namely, flavor.

With this in view, the development of the dairy business in Kansas depends on the care the farmer will give to his milk and cream and the care the creameryman will give to his butter in order to produce a product of the finest quality and one that will command the highest price. Cream or milk which tends to lower the grade of butter will lower the price of butter, and hence will make the dairy business less profitable.

#### THE GRADING OF CREAM.

With the above conditions before us it would be a legitimate plan for creamery companies to grade the cream they receive on a similar basis, and instead of paying a uniform price for butter fat, regardless of the quality of the cream, it should be graded and the cream having the best quality should receive the highest price. In this way a man exercising great precaution in producing pure cream, by building better barns, better milking stables, by getting better cows and feeding them better and keeping them healthier, by exercising great care in milking, by running the milk through a scrupulously clean separator and by cooling the cream and delivering it often in good sanitary cans, will thereby receive a reward for his efforts and his expense, and will be encouraged to do even better. Nearly all other farm products, such as wheat, corn,

live stock, butter and cheese are graded and sold on their merits, so it is only fair to the man who sells cream that he should have a similar condition presented to him.

#### GRADES OF CREAM.

Cream should be graded as follows: First grade, second grade, and third grade.

First-grade cream should be pure and sweet, containing not more than 0.2 of one per cent of acid, should have no undesirable flavors or odors, should be fresh (not older than three days), and should contain not less than 30 per cent of butter fat.

Second-grade cream may be slightly sour, containing not more than 0.3 of one per cent of acid, not older than five days, should contain no taints, and should have not less than 30 per cent of fat.

Third-grade cream may be somewhat stale, somewhat tainted, and may contain less than 30 per cent of butter fat.

#### ACIDITY AND THE ALKALINE TEST.

When cream is pure and sweet, containing less than 0.2 per cent of acid, it indicates that the cream has been produced under sanitary conditions and must have been kept cool. Since the lactic acid is developed from the milk sugar, and since the bacteria do not grow in a cold temperature, it farther indicates that there are small numbers of bacteria in the milk.

Cream produced under clean conditions does not sour rapidly, owing to the fact that there is a less number of bacteria in the cream. To detect the above amount of acid a test is used which is known as the alkaline test.

The alkaline test consists of an alkaline solution, an indicator, and a graduated cylinder or burette, a 50 c. c. pipette with which to measure out the cream, and a cup. The principle depends on the fact that the alkali neutralizes the acid of the cream. Any alkali can be used in making this standard solution; for instance, lime, lye, soda, etc. However, for testing purposes these must be chemically pure; hence, if lime is used the solution is added to sour milk and the acid unites with the lime, forming a substance which is neutral, neither alkaline nor acid. The alkalinity of the solution must be known, and hence it is termed a standard solution. If a certain alkali neutralizes a certain acid and this is a constant factor, and the strength of the alkaline solution is known and the point at which both neutralize each other can be determined, the amount of acid in the milk can be calculated. The way to determine the neutralizing point is by means of an indicator which turns pink if the solution is alkaline, and turns white or colorless

when the solution is acid. This indicator is commonly known as phenolphthalein. The alkali can be bought in bottles from any chemical laboratory and can be shipped to the farmers at a nominal cost, and is made by dissolving four grams of pure sodium hydroxide, to which enough distilled water has been added to make one liter of solution. This makes what is commonly known as a one-tenth normal solution.

With the apparatus and solution at hand, measure 50 c. c. of cream with a pipette into a beaker or cup, then with the same pipette add 50 c. c. of pure distilled water, then add 5 drops or more of indicator. Fill the burette to the zero mark with alkaline solution, but before doing this be sure to see that the burette is absolutely free from water and acid. Probably the best way is to rinse the burette with a little of the solution. Now add the solution to the cream in a slow manner until you notice that the cream solution appears very reluctant in destroying the pinkish color on stirring. Then this neutralizing solution should be added drop by drop **only**. The moment the cream remains pink the acid has been neutralized. The number of cubic centimeters added to the cream is read on the burette, and from this the percentage of acid can be calculated in the following manner:

Number of cubic centimeters of alkali multiplied by .009, divided by the number of cubic centimeters of cream multiplied by 100.

Example: If it requires 32 c. c. of alkali to neutralize 50 c. c. of cream, what per cent of acid is there in the cream?

The formula would be :

$$\frac{32 \times .009}{50} \times 100 = .576, \text{ the per cent of acid in the cream.}$$

#### FLAVORS AND ODORS.

The causes that produce undesirable flavors and odors in cream are as follows:

1. Cream produced from abnormal milk which has been drawn from diseased cows.
2. By feeding the cow mouldy or partially decayed feeds.
3. By keeping the animal in uncomfortable conditions, which cause her to become feverish or excited.
4. By milking a cow in a filthy stable, or near decomposing material.
5. By allowing cows to wade around in mud puddles or cess-pools and then milking the cow without washing the udder.
6. By milking the cow with dirty hands, or by milking on the hand in order to wet the teat. Under all conditions, **milk the cow**

with a dry teat. If the teat is chafed or sore use Vaseline instead of milk to moisten it.

7. By milking into filthy pails or pails that have not been scalded with hot water. In washing the milking utensils it is advisable to use hot water and some washing powder, and finally rinse with boiling water, or steam over a steam jet.

8. By running the milk through an unclean separator. (See bulletin No. 131, Kansas Exp. Sta.) The separator should be taken apart and washed every day. If the separator is used twice a day it is preferable to take it apart and wash it both times, but, if time does not permit this, at least five gallons of warm water with some washing powder should be run through it, followed by a gallon of boiling water without the washing powder.

9. By running cream into a filthy can. Care should be taken that cream should be put into a clean milk can that has previously been scalded and cooled.

10. By not cooling the cream to a proper temperature. After cream has been separated it should be cooled to at least 60° F., and lower if possible. By putting cream from two milkings together care should be taken that the cream added last is thoroughly cooled.

11. By not properly covering the cream can with some cloth in the summer when driving long distances to the station.

12. By letting cream stand at stations for a long period of time.

#### DELIVERY.

Cream should be fresh and should be delivered at least twice a week in winter and three times a week in summer. Cream kept for longer periods of time, unless kept on ice, will produce a rancid flavor when churned into butter. Hence, a man delivering cream must deliver as often as this or his cream will not be first grade.

#### PER CENT OF FAT.

First-grade cream should contain not less than 30 per cent of butter fat, for the reason that cream with this per cent of butter fat will keep better and costs less to transport than cream of a lower per cent of fat, and the dairymen will recover more skim-milk.

Some causes that tend to lower the butter fat to below 30 per cent in cream separated with a cream separator:

The variation in the per cent of butter fat of hand separated cream is very great if operators are not careful in operating their machines uniformly. There are several factors that influence the test of cream from separators. The first and probably the most

important cause that reduces the per cent of butter fat in cream is by turning too slowly, not giving the bowl enough speed. Anything that tends to change the speed of the bowl from one separation to another influences the per cent of butter fat in the cream. A uniform speed of the bowl is obtained by turning the crank at a given speed at all times and giving the crank an equal pressure at all points in its circuit around the axis. The speed at which the machine should be run is indicated by the manufacturer. Follow these instructions and count the revolutions each time the machine is used, to be sure that the speed is maintained.

If milk is warm the cream will contain a slightly higher per cent of butter fat; if cold, it will contain slightly lower per cent other conditions being equal. Milk immediately after it is drawn from the cow has the proper temperature at which to separate.

Milk should be run through a separator at a constant rate. If milk is fed into the separator at an uneven rate, if at times the flow of milk be stopped, the thickness of the cream will be greatly influenced. The faster milk is run through a separator, the thinner will be the cream, other conditions being equal.

The amount of water or skim-milk used to flush out the bowl will naturally tend to decrease the per cent of butter fat by diluting the cream with water or milk.

There is a cream screw or skim-milk screw in each separator for the purpose of changing the thickness of cream when desired. By this it can be so regulated as to skim thin or thick cream, and when once set, if all other conditions of the separator are uniform, it will produce nearly a constant per cent of butter fat.

These principles hold true in all cream separators, and explain why the per cent of butter fat sometimes runs below 30 per cent.

While all the points mentioned herewith can be known without depending upon the judgment of any particular individual, as for instance, determining the amount of acid in the cream, the frequency of hauling the cream, per cent of butter fat in the cream, etc., there however remains one point still unsolved which is directly dependent on expert judgment, namely, the flavor of the cream.

A cream may be acid and have a pleasant flavor and odor, and on the contrary a cream may be sweet and have a bad flavor. As yet no test has been found that will determine the flavor absolutely except the taste and smell of man. Hence, while it is a simple and practical problem for all creameries to adopt the schemes as suggested above, in due justice to the producer as well as the creameryman, there should be in as many places as the business would

permit, men who are competent and efficient in judging flavor and odor of cream. Such a man, in order to give universal satisfaction, must have some experience in the judging of cream. He must furthermore have some knowledge of the physical and chemical properties of milk and cream. In short, he should be a man well versed in dairy lines in order to impart information to those who need it, and at the same time stimulate and keep up the progress in dairying.

While this method would be only practicable in localities where dairying is carried on quite extensively, there is, however, a second manner of handling cream, namely, to have each farmer send his cream directly to the creamery. This is a very satisfactory method to the creamerymen and also to the producer if the producer is located on a direct shipping point to the creamery, but wherever transfers need to be made, the grading of this cream at the factory would be unjust to the producer since the railroad company is quite often responsible for delaying shipments at the transferring station. To overcome this point it is quite necessary, in order to raise the standard of butter, to operate refrigerator cars for the purpose of transporting cream long distances, and it is hoped that in the near future dairying will develop to such an extent as to make it profitable to use refrigerator cars for transporting this product.

#### CONCLUSION.

The Dairy Department of the Kansas State Agricultural College inaugurated this scheme of grading cream nearly two years ago. It has given universal satisfaction to the patrons and has produced a marked improvement in the quality of the cream. On account of the practicability of this scheme, and its legitimacy both to the producer and consumer, we feel that every creamery-man and dairyman should indorse and help to promote the idea of grading cream upon its merits.