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Production of Quality Milk and Cream on the Farm

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Production of Quality Milk

Thomas M. Olson

High quality milk is milk of good flavor from healthy cows, milk free from dirt, and containing a small number of bacteria, none of which are harmful.

Much of the milk as it comes from the cow is of high quality, but it does not always remain so because of conditions under which it is produced and handled. Hence much attention must be given to these phases of milk production if contamination is to be kept at a minimum.

Milk of good flavor will greatly increase the consumption of market milk as well as dairy products made from it. Flavor and odor are important factors in the consumption of any food. Hence, the production of a high quality milk has an economic significance which the dairyman must not overlook.

Much has been discovered in relatively recent years on the food value of milk. These scientific findings leave no doubt as to the nutritional value of the most nearly perfect food known. Yet, unless this product is produced and handled under conditions which will obviate contamination the knowledge of the nutritional value of milk will be for naught so far as increased consumption is concerned.

Barns and Stables

The first source of milk contamination after it is drawn from the udder is the condition under which the milk is produced. If the barn and stables where the cows are housed and milked are such that filth and dirt cannot be kept out of the milk it avails little to observe precaution in the further handling and processing of the milk. It is not necessary to have a costly stable in order to have cleanliness. However, there are certain conditions which must be observed.

The stable where the cows are housed during milking should be so constructed that it can be thoroughly cleaned. This assumes that the gutter at least shall be of material that will not absorb the liquid manure. It is well nigh impossible to produce a high quality milk in a stable where the odors of absorbed manure are ever present. Unless facilities are provided for the liquid manure to run off, these odors will be present. Liberal bedding will be an important factor in the absorption of much of the liquid manure. However, sufficient liquid manure will seep through to soak the ground if the gutter and stalls are not constructed so as to prevent it. It is not necessary from the sanitary point of view to have steel stanchions, cement floors and mangers, drinking cups, etc., desirable as these are. It is true, however, that without these features in the stable greater care must be observed if one is to produce quality milk. That it can be done without these desirable features no one can gainsay.

Bedding is important in any dairy stable regardless of the material

used in its construction. Bedding is used to absorb liquids and keep the cows clean. However, very often the straw used as bedding is dusty or moldy. Dusty straw would cause the dust to rise in the stable, particularly during the milking period. Much of the dust would get into the milk and thereby increase very materially the bacterial count. Moldy straw would similarly contaminate the milk, depreciating very materially its quality. Hence, clean, bright straw should be used whenever it can be had. Shavings make a clean, fresh smelling material to use for bedding but it is usually too high in price compared to straw in South Dakota.

Flies

Flies in the milking stable very often are a source of contamination of milk and every effort should be made to reduce their numbers to a minimum. Flies are also a dangerous source of pathogenic diseases because of their habit of feeding on decayed materials and inhabiting unsanitary places. The bacteria are carried on their legs and body. When the flies are permitted to come into contact with the milk or milk utensils the bacteria are deposited and thus contaminate the milk. If the bacteria are of the pathogenic or disease producing type naturally the milk will become contaminated with this type of bacteria.

The stable can be darkened by hanging burlap sacks or other material over the windows. The window panes can also be painted over with black or dark kalsomine or other materials which can be washed off after the fly season. A darkened stable is a big aid in keeping flies out. Burlap sacks slit into ribbons and fastened over the door will brush the flies off the cows as they enter the stable and thus reduce the number in the stable.

A fly spray which kills flies is a potent factor in keeping the flies at a minimum, particularly if it is used in the early part of the season when the flies are just beginning to infest the stable and late in the fall when the nights are cool. During the fall one can reduce very materially the number of flies which will winter over in cracks and crevices, and thus have fewer flies to contend with the following season.

Flies breed and live in manure and filth. Therefore, manure and filth should be taken out of the barn every day so as not to provide a breeding place for flies, as well as for sanitary reasons. High quality milk can not be produced in a barn in which manure or filth is permitted to remain for even a short period of time. It is not sufficient merely to pile the manure outside the stable door or windows. It must be taken away far enough so that the flies will not come to the stable when hatched.

The Cows

It is too obvious to require discussion that cows which produce a food used so universally by the human family as milk is, should first of all be in good health.

It has been definitely proved that certain diseases to which the bovine species is subject are transmitted to the human being through the milk. Many cases of tuberculosis in children, particularly tuberculosis of the bones, joints and digestive tract have been traced to bovine tuberculosis

through the milk. The danger of such transmission would be particularly important if the cow should have tuberculosis of the udder or other glands closely associated with the mammary system. Other diseases, such as garget, make the milk unwholesome if not definitely harmful, and therefore should not be consumed or sold.

The condition of the cows aside from their health may be a very potent source of milk contamination. Dirty cows with dried manure on their flanks, bellies and legs are good sources for ruining what might be a good quality milk. A small piece of such dried manure or a cow hair, may and frequently does contain millions of bacteria. The bacteria reproduce very rapidly under the favorable conditions found in the milk and soon affect unfavorably the quality of the milk.

Clipping the flanks, belly, udder and hinds legs to the region of the hock will do much in keeping the cows free of manure. If the clipping is done late in the fall one clipping will suffice for the winter season. This simple yet effective herd management practice will do much in improving the quality of milk.

The udder of the cow should be wiped with a moist cloth dipped in a disinfectant solution previous to milking. This will wipe off any loose hairs or dust and prevent them from falling into the milk pail. Needless to say, the udder and teats should be wiped dry before milking is begun. It may even be necessary to wash the udders of cows which have become fouled by manure. After the udder has been washed it should be wiped dry with a clean cloth.

The cows should be curried at least once each day to prevent the falling hairs from getting into the milk. The cows should not be curried and brushed shortly before milking. Give the dust and loose hairs time to settle or to be taken from the barn through the ventilating system before milking time. Healthy cows, clipped and curried as indicated above, will go a long way in the production of high quality milk.

The Milker

The milker can be a means of lowering the quality of the milk he milks and handles. Needless to say a milker should always milk with dry clean, hands. Wet-hand milking is a filthy practice that should not be tolerated. One who has learned to milk with moist or wet hands will find it difficult to change to dry hand milking. If such an individual must milk, the use of a small quantity of vaseline will give the same results as moisture and be infinitely more sanitary as well as better for the teats of the cows.

The clothes of the milker under ordinary conditions will not be a source of contamination. This should not be interpreted, however, to mean that the milker should wear dirty overalls or be dressed in a manner that will give one the appearance of being dirty. The milker who will keep his hands clean and appreciate the need for sanitation in the production of high quality milk can usually be relied on to wear clothes which will not contaminate the milk.

The milker may be a means of spreading pathogenic bacteria. Typhoid fever, diphtheria, scarlet fever and septic sore throat are sometimes transmitted from the milker to the milk or milk utensils. No one who is not in good health should be permitted to milk or handle the milk at any stage in its processing; neither should they be allowed to handle the dairy utensils

or have any part to play in the handling of a food which is so universally consumed by children and invalids, and a food which provides such a favorable medium for growth of bacteria of most types.

Utensils

From the standpoint of numbers of bacteria the various utensils used are the greatest sources of contamination. The reason for this fact is that bacteria will remain in the utensils unless they are thoroughly cleaned and sterilized. These bacteria increase very greatly in number between milking periods. This is especially true when the utensils such as pails, cans, coolers, etc., are kept in a room at a temperature favorable to bacterial growth.

A milk pail may contain only a small number of bacteria after washing. These will be increased to millions by the next milking period. When the fresh warm milk is milked in to the pail the entire mass of milk has become seeded with bacteria. Most, if not all of these bacteria, are acid producers, hence the milk will sour in a very short time.

The milk pail is only one of many utensils in which similar conditions obtain. The milk cans, the cream separator, the milk coolers are all prolific sources of bacterial contamination and every care must be exercised in keeping these utensils clean and sterile if one wishes to produce a high quality milk. To keep this source of contamination at a minimum use utensils which can be easily and thoroughly cleaned. Avoid milk pails which have deep seams, cracks, or crevices in which bacteria and particles of milk can lodge.

In cleaning milk pails rinse them with cold water first. Hot water will cause the casein of the milk to set and it makes it more difficult to remove. Use a scrub brush or a regular dairy-plant brush. Never use a cloth for washing the utensils. Use washing powder, not soap. Washing powders can be purchased at any of the dairy supply houses in any quantity desired.

After the utensils have been rinsed with cold water, wash them thoroughly with the brush and washing powder in moderately hot water. When the utensils have been cleaned, sterilize them with boiling water or steam. See to it that they dry thoroughly. Before using, rinse the utensils with a chlorine solution. If this procedure is followed and a thorough job is done the bacterial contamination from the utensils should not be a serious matter.

Type of Milk Pail

The size of opening of the milk pail is an important factor in admitting dust and hair from the cow as she is being milked. It is well to have the opening in the pail as small as is practical from the standpoint of producing milk of low bacterial count. However, the opening must be large enough for one to milk into without inconvenience, and without slowing up the milking process. There are a number of types of partially covered top milk pails on the market, which combine the covered feature as well as being easy to wash and keep clean.

Strainers

If no foreign materials enter the milk during any stage in the production and handling obviously there would be no need for straining the

milk. However as every dairyman knows, it is difficult if not well nigh impossible to handle milk under practical farm conditions, and not get some foreign materials in the milk at some time. Hence a strainer is desirable to catch such materials.

Obviously a strainer should not be a source of contamination which it is if proper precautions are not observed. Metal, wire or screen strainers will harbor bacteria in the same way as any other dairy utensil; hence they should be cleaned and sterilized as effectually as the milk pail or milk can.

The use of cloths for strainers cannot be recommended because they are difficult to clean and sterilize under farm conditions. If this is not done, the strainer cloth will be a most potent source for bacterial contamination.

The most sanitary and effectual method of straining milk is to use cotton filter pads. The pads are discarded after being used, and need no further attention. The expense of straining will of course be increased, but if the cotton filter pads make possible the production of a higher quality of milk, this added expense is necessary and justified.

Cooling Milk

Prompt and efficient cooling of milk is highly desirable from the standpoint of quality. Milk which is cooled to a temperature of 50 degrees F. or better still 40 degrees F. as promptly as possible after milking is greatly improved in flavor. Prompt and efficient cooling is also important in the keeping quality of milk.

The bacteria which are responsible for the souring of the milk do not materially increase in numbers or multiply when the temperature is lowered to 50 degrees F. or lower. In other words, the bacteria react to low temperatures similarly to flies and insects during the winter. When cold weather sets in in the fall the flies become less active. Soon they find a crack or crevice into which they can crawl, and spend the winter. When the first warm days of spring return the flies again become active and soon begin depositing their eggs and increasing their numbers.

When milk is cooled promptly after milking the bacteria which are in the milk will not increase in numbers. If the milk is not cooled the bacteria will double their numbers in about thirty minutes. In other words, they will increase in geometrical progression so long as conditions remain favorable. Consequently, if one bacterium were to continue at this rate for 24 hours, the progeny would number in the millions. Under the most sanitary conditions, when the greatest possible precautions are observed, milk will contain bacteria numbering in thousands. In fact certified milk which is produced under the most rigid conditions of sanitation and cleanliness permit 10,000 bacteria per cc. (1cc. of milk is approximately equal to 20 drops). Milk purchased under ordinary farm conditions may vary from several thousand to several million bacteria per cc.

It must not be inferred from the above statement that these bacteria are necessarily harmful except that they do affect the quality of the milk. It must also be thoroughly understood that these bacteria are found everywhere. A particle of dust may be the means of transportation of millions of bacteria. So beware of taking dust into the system.

Few dairy farmers have artificial means of refrigeration. The only medium for cooling milk and cream is water, and in some instances the water is not very cold, particularly during hot weather when the cooling is most necessary.

If one has flowing water, or water under pressure, the surface cooler is an excellent means of cooling milk promptly and efficiently. The water, or cooling medium, flows through the tubes while the milk flows over the outside of the cooler in a thin film. The milk is immediately cooled to within a few degrees of the temperature of the water or other medium and at the same time aerated.

If water under pressure is not available, then the milk must be cooled in cans. If it is possible to arrange the cooling tank so that the cold water will pass through it and the overflow can flow to the stock tank, this makes a very satisfactory arrangement. The cooling water is thus conserved for use to the livestock.

Milk in cans, even when the cans are placed in the cooling tank, must be stirred until it is cooled to about the temperature of the water. If the milk is not stirred the portion of the milk in the center of the can will not be cooled promptly and so will permit the bacteria to continue active and increase in numbers.

During cold weather, the dairyman too often neglects the proper cooling of milk and cream. The milk and cream are placed in cans or other containers and allowed to stand in a cold place without stirring. Water is twenty-five to thirty times as efficient a cooling medium as air of the same temperature; hence milk can be cooled more promptly in water. Too often this fact is overlooked in the production of quality milk and cream during the winter months.

What has been said about the importance of cooling milk and cream should suffice to convince anyone of the folly of adding warm cream to cream which has been cooled. This procedure would warm up the entire mass of cream to a temperature at which bacteria would immediately start growing and deteriorate the product.

Flavors and Odor of Milk

It is possible to produce milk under the most rigid conditions so far as sanitation is concerned, and yet have milk of undesirable flavors. In other words, sanitary practices will keep bacteria at a minimum and avoid the flavors incident to their development, yet undesirable flavors may appear in the milk due to other conditions.

Abnormal or off flavors and odors of milk are usually due to the following causes:

1. From the normal and abnormal fermentation and decomposition of the milk constituents. These changes are brought about by the action of bacteria.
2. From the cow, due to disturbed physical condition. The substances giving these objectionable tastes are secreted with the milk.
3. From the feed or feeds. Some feeds have volatile substances which are carried in the blood and are passed into the milk at milking time.
4. From the absorption of odors to which the milk is exposed. Barn odors, feed odors, and potato odors so frequently present in milk usually enter by absorption.

It may be an aid in the production of high quality milk to know the

flavors and odors peculiar to each source and what can be done to prevent these flavors and odors.

The taste and odors brought about by bacteria are, first, sour milk. Sour milk is not harmful to the consumer, but is definitely unsalable as a fluid milk. The lactic acid is produced from the action of acid producing bacteria on the lactose or milk sugar, producing lactic acid. If the milk is allowed to age, other types of bacteria in the milk will proceed to increase in numbers and decomposition products will appear in the milk. After this stage, molds and yeasts will make their appearance.

There will be little opportunity for all these fermentative changes taking place in milk because fluid milk is not kept long enough. However, these stages of fermentation and decomposition are frequently noted in cream.

Bacteria of different types may produce objectionable odors, and tastes as well as abnormal colors in milk. However, these types of bacteria are not common and are rarely responsible for these off flavors and odors.

There have been outbreaks among South Dakota milk distributors of slimy or stringy milk due to specific bacteria. This condition is usually noted after the milk is twelve to twenty-four hours old. The milk resembles viscous cream. When the milk is poured from the bottle it will flow in long strings.

All abnormal conditions appearing in fluid milk due to bacteria, can be corrected only by preventing the growth of the bacteria in the utensils with which the milk comes in contact, or killing the bacteria in the milk by pasteurization or sterilization.

FLAVORS AND ODORS in fluid milk due to disturbed physical condition of the cow are not common. When the physical condition of the cow is such that the milk is affected, a good dairyman will know it and refrain from putting the milk on the market.

Cows which have milked for a long time, and sometimes cows which are nearing the end of their lactation period, will produce a bitter, or saltish milk. These flavors are probably due to enzymes in the milk and the condition cannot be corrected. When the cow freshens these flavors will not be present in the milk.

FEED FLAVORS, which are carried in the blood of the cow, are frequently the cause of objectionable flavors and odors. Feeds which produce these pronounced flavors and odors in milk are wild onions or leeks, French weed, green rye, rape and cabbage. Sometimes green clovers, and even grass when the cows are first turned on pasture, will produce milk of undesirable flavors and odors.

If the cows are taken off pasture two to three hours before milking the milk will not have the flavors incident to these feeds. This would not be true in the case of wild onions or French weed. Experimental work has indicated that the flavors from these weeds will be detected in the milk after seven hours have elapsed between taking cows off these feeds, and milking time. It is obvious, therefore, that cows should not be allowed on pastures where these weeds are growing.

It is good management from the standpoint of the production of high quality milk to feed the grain, silage and hay after milking instead of

before milking as is so frequently done. When cows are on pasture they should be taken off at least two hours before milking time.

ABSORBED ODORS.—Perhaps most off flavors and objectionable tastes in milk are absorbed during milking, cooling or storage of the milk. Milk, particularly warm milk, readily absorbs odors of all kinds. Many of these odors are not objectionable in themselves but when they get into the milk they produce flavors that are highly objectionable. For instance, the odor of fruit is not objectionable to the most sensitive individual, yet when this odor is absorbed by milk or cream it may produce flavors that are highly objectionable.

Obviously the only way to avoid absorbed odors is to prevent them from getting into the milk. In other words, handle and store the milk and cream under conditions where there are no odors of any kind. The dairyman who wishes to produce a high quality milk keeps ever before him the fact that milk absorbs odors as readily as a sponge takes on water.

Tests for Clean Milk

The proper tests for quality milk can be made only in a properly equipped laboratory. The sediment test will indicate the cleanliness of the milk. It does not, however, indicate the bacterial content. Usually milk which has much sediment in it is also likely to be high in bacteria.

The length of time required before the milk sours is an indication of the cleanliness and bacterial content of the milk. It is an indication only. For instance, milk may be very clean from the standpoint of sediment but one of the utensils may be heavily seeded with the acid type of bacteria and when the fresh milk comes in contact with these bacteria it will sour quickly because of the heavy contamination of acid forming bacteria.

Bacterial count of milk is the most accurate indication of its quality, particularly if the type can be ascertained as well as the number. This is impossible unless one has laboratory facilities and understands bacteriological technique.

The Methylene blue reductase test is used in ascertaining the approximate bacterial content of milk. This test merely indicates in a general way the gross number of bacteria present. That is, if it requires a certain length of time, say more than six hours before the blue color disappears in the test tube, the assumption is that the milk is not high in bacteria. In other words, it indicates in a relative way only, the bacterial content. The test is very well adapted to field work in grouping milk into classes, say as good, fair, and poor milk.

Certified Milk

Certified milk is raw milk produced under the rigid supervision of a medical milk commission. Certified milk can only be produced and sold as such, where the medical commission can provide the proper inspection and certification. It should be clear, therefore, that one cannot label milk produced under very sanitary conditions and for all practical purposes milk equal to certified milk in every respect, as certified milk unless the proper medical commission has actually made the certification.

Pasteurized Milk

Pasteurized milk is milk which has been heated to a temperature of 142°F. to 145°F. and held at this temperature for 30 minutes. Nothing is added to pasteurized milk. The purpose of pasteurizing milk is to destroy bacteria, both the nonpathogenic and the pathogenic types if there should be any in the milk.

Grades of Milk

Cities frequently designate several grades of milk, such as Grade A, B, C, or Grade 1, 2, 3, etc. These grades may, but frequently do not mean the same thing in different localities. In other words, grades of milk are not produced under the same uniform regulations as is the case with certified milk. Therefore one cannot be definitely assured that Grade A milk in a particular locality is a milk of assured high quality. It is fair to assume, however, that it is probably the best milk produced unless certified milk is being sold in the locality.

Formulating a Milk Ordinance

A milk ordinance is the legal authority which gives the citizens of a city or community, through the Board of Health, power to supervise and control the milk supply.

Milk ordinances in various cities differ because they are formulated so as to fit the needs and wishes of the citizens of the respective community or city. However, all ordinances are concerned with three general phases, viz: fraud, disease and cleanliness in the production and handling of the milk. The specific ordinance, therefore, would stipulate rules and regulations protecting the milk consumers of its community against these conditions.

The ordinance should not be so formulated that the supply of milk is curtailed to the point where the milk supply is not adequate to take care of the needs and demand of the community. Neither should the ordinance be so rigid in its requirements that it cannot be properly enforced. When the ordinance cannot be properly enforced there is danger of its becoming an instrument for privileged milk dealers.

The ultimate goal of any milk ordinance should be to improve the quality of the fluid milk sold in the community without seriously decreasing the supply. With this as an objective it may be necessary for the Board of Health through its inspection department to do some educational work and assist the milk distributors to improve the supply of milk. If the producers and processors are not amendable to suggestions for improvement the ordinance should be enforced without fear or favor. The consumer is not only entitled to safe milk, but milk of high quality as well. Milk of high quality will be a boon to the milk producer and an indispensable food to the consumer.

Score Card for Milk and Cream
(Approved by the American Dairy Science Association)

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

	Perfect Score	Score Allowed	Remarks
Bacteria	45		(Bacteria found per cubic centimeter) -----
Flavor and odor	25		Cowy, bitter, feed) flat, strong, cooked) -----
Sediment	10		-----
Temperature (street sample)	15		Degrees -----
or			or
Acidity (prepared sample)			Percent -----
Bottle and Cap	5		Bottle -----
			Cap -----
Total	100		

Exhibitor -----
 Address -----
 Signed -----
 Date -----

Quality Cream

C. C. Totman

Cream is obtained from milk and the quality of milk produced determines largely the quality of dairy products made. Part I of this publication discusses the production of quality milk. The cream producer must know and observe similar practices.

Cream Separation

Granting that milk has been produced under reasonably satisfactory conditions we shall consider the details of cream separation and their bearing on the production of a high grade cream. The cream separator must be washed after each run. The parts must be placed where they will not rust and should dry promptly from the heat acquired from the hot water used to wash and rinse the parts.

If separators are properly washed and dried there is less need for chlorine sterilizers which many are using. The use of these solutions is not discouraged as they are of great help after careful washing of the separator. These sterilizer solutions should be rinsed from the utensils a few minutes after use as they tend to induce rusting and may cause off flavors in the cream. These sterilizers are quite ineffective unless the equipment is clean before the sterilizers are used. If chlorine comes in contact with milk and cream, it attaches itself to them and is so weakened as to be comparatively useless.

Separate the cream as promptly as possible after milking because—

- 1.—In winter, milk cools rapidly and the colder it is the less efficient is separation.
- 2.—In summer the warm milk favors fermentation which starts promptly.

Run the warm cream into a separate can and set it in cold water. A tall slender can (shotgun type) cools the cream most quickly. At the time of the next separation, pour the cream into the larger can used to send the cream to market. Never run warm cream into cold cream. Peculiar flavors are thus produced and the buyer may be compelled to place such cream in a lower grade even though it may be sweet.

Cream should be delivered to market as often as possible. A minimum weekly schedule of three trips in summer and two trips in winter is suggested. Proper care should always be exercised in producing cream. If cream cannot be marketed regularly, it is still more important to see that all details in production and storage are carried out.

It is often a problem to know where to store cream on the farm. The ideal place is in a milk house where a tank of cold water is provided. The water from this tank is freshened and cooled with water direct from the well. Do not cover the cream tight. A small vent is desirable and is furnished by hanging a piece of wire over the edge of the can and under the cover or by covering the can with a piece of muslin cloth.

Without a milkhouse, cream is stored in various places and often with poor results. Such places as the cellar, the cow stable, the kitchen, the back porch, a root cellar, an old well, etc., are used. These places often vary greatly in temperature and the cream suffers in consequence. In an effort to keep cream cold it is often frozen, and such cream makes

a poor grade of butter. In finding a place to store the cream, bear in mind the following:

1.—Temperature between 35 and 55 degrees F.

2.—Proper ventilation and absence of odors. If the cellar is used to store cream, keep it clean and well ventilated. Set the cream can in water and keep the water fresh. Have a small tank of water to store cream in. If cold water cannot be kept in this tank in the summer, the cream should be stored elsewhere. Always guard against flies and other insects. Cream comes from the separator practically free from sediment. In order to comply with pure food requirements of the national government and of most of the state governments it is necessary to keep the cream free from sediment. This means that it must be kept covered as completely as possible and still permit ventilation. A muslin cloth cover if kept clean will exclude insects, rodents and most dust, except in case of dust storms when a tight cover is advisable. See that the can-cover and mouth of the can are free from dust. It may be necessary to wrap the can and cover with a clean cloth which will exclude dust on the highways, especially where cream is hauled in open trucks.

When cream is gathered in trucks it is highly desirable to have a covered truck body. This reduces the fly menace, the gathering of dust on the cans, and the seepage of rain under the covers and into the cream. Umbrella covers or covers with a rolled edge with no holes for wiring are preferable. Rain must be excluded from the cream as it introduces some sediment.

If cream is hauled in open trucks, the type of can covers just referred to, are very necessary. A tarpaulin to cover the cans is also a necessity.

1.—It protects the cans from dust, rain and flies.

2.—It keeps the cream cool, especially if it is sprinkled with water.

3.—It protects against freezing in winter.

The hauling of petroleum products, hides, wool or any malodorous materials should be rigidly guarded against.

Long distance rail shipment of cream presents a difficult problem, particularly in warm weather. The cost of providing for any type of refrigeration is prohibitive, due largely to the irregularity of the time and volume of such shipments. Wet burlap bags used to cover cans enroute have helped considerably, but much remains to be done to solve the problem of long distance transportation of cream. Trucking of cream to points where rail shipment is faster has helped materially in some instances. In brief, a few rules must be observed.

1. Carefully grade cream when purchased and do not mix different grades.

2. Cool the cream promptly when received and ship as soon as possible.

3. Find the shortest time route to the creamery.

4. Avoid exposure to heat at railway stations by delivery shortly before train time.

5. Induce rail companies not to expose cream to the heat of the sun.

6. Do not attempt to ship cream too far.

7. Persuade your patrons to give particular care to cream intended for shipment and to deliver it more frequently.

Cream Grading

Three methods or bases for grading cream have been used. These are:

1. Acidity basis—that is, sweet or sour.
2. Time basis (4 day plan as sponsored by Purdue University—Lafayette, Ind.)
3. Quality basis with a price differential exemplified by the Canadian Provincial grading laws.

The outstanding considerations in grading cream are as follows:

1. Flavor and odor.
2. Acidity, especially above .6%.
3. Presence of yeast and gas.
4. Age.
5. Presence of insects, sediment, etc.
6. Presence of molds, especially colored molds.
7. Container-rust, open seams, type cover, etc.

The acidity basis of grading, obviously is incomplete. It has been used because it is easy to practice. Cream may be relatively sour and make a good grade of butter.

The time basis also is incomplete. The flavor and odor of cream are much more important and are the paramount considerations in any scheme of grading. As a method of cream improvement, the "four day plan" has value and it is not difficult to practice.

The third basis for grading, viz. "Quality with a price differential" takes into consideration most of the points listed above. It is best explained by giving the specifications of the Canadian grading laws.

The Canadian plan provides for five grades of cream as follows:

Effective Mar. 1924

Grade Name	Acidity limit	Flavor description	Price Differential
Table cream	.20%	Sweet— not frozen—for household use	2¢ over No. 1
Special grade	.30%	Clean—uniform—will make butter of this grade (special)	2¢ over No. 1
No. 1 grade	.60%	Clean—uniform—will make butter of this grade (No. 1)	3¢ over No. 2
No. 2 grade	none	May be bitter, stale, metallic or otherwise unclean—below No. 1 grade	
Off grade	none	May have kerosene, gasoline, stink weed, onion, etc., and will not make No. 2 butter	Not specified

Government trained graders work in creameries and are paid by the government while grading cream. When not so employed they do other creamery work and then are paid by the creamery. They are shifted from one creamery to another as directed by the provincial officer.

Here is how the compulsory grading law in Canada worked the first four years after its adoption.

		Data Manitoba Agric. College				
		Percent Table Cream	Percent Special Cream	Percent No. 1 Cream	Percent No. 2 Cream	Percent Off grade Cream
1923	8 mos.	15.1	7.4	55	21.3	0.60
1921	12 mos.	25.1	8.3	53	18.0	0.50
1925	12 mos.	32.4	10.0	45	12.1	0.35
1926	11 mos.	34.3	9.7	44	11.2	0.39

It will be noted in these specifications that sediment and molds are not mentioned, but it is very likely that they are taken into account in actual grading. These two points are of vital concern in the United States because of the recent activities of the federal and state governments.

Visible mold on cream on the inside of cans and covers is objectionable. *Oidium lactis*, the white mold sometimes found on dairy products is less objectionable than the colored molds, but its presence indicates that cream is very old and that very little attention is given the cream cans. Colored mold on either the cream or the can is sufficient reason for condemning cream.

Sediment tests should be run on the cream of all patrons. Surprise tests should be made once or twice per month and if a patron's cream is not clean, tests should be run on all deliveries until improvement is noted. He should be paid in accordance with the grade determined and the sediment test may be the determining factor in establishing the grade.

Sediment testers are obtainable from the creamery supply houses. In addition to these, other testers developed recently have come to our attention.

The question of grading or rejecting cream when the amount and kind of sediment is the determining factor is difficult to decide. The federal pure food department states that cream containing sediment in amounts and of such nature as to be considered unfit for human food by persons of acceptable standards of cleanliness shall be rejected as illegal cream.

State Cream Grading Laws

A model statute was drawn up by a national "Creamery Industry Committee." This was submitted in Dec. 1934 and was intended for use by State legislatures in framing state cream grading laws. Its essentials are as follows:

First Grade Cream shall consist of cream that is clean and sound, smooth, free from undesirable odors and flavors, sweet or slightly sour, and shall contain not less than 25% of butterfat.

Second Grade Cream shall consist of cream that is clean and sound; may contain "off" flavors or odors in a moderate degree or may be too old to pass as First Grade Cream.

Unlawful Cream shall consist of cream which contains dirt, filth or other foreign matter which makes it unfit for human consumption; or that is stale, rancid, putrid or decomposed.

Cream buyers shall affix tags to unlawful cream (tags furnished by the State Dept. of Agric.). They shall also place a permanent harmless coloring matter in the cream.

The cream buyer shall ship cream within 24 hours to a manufacturing plant except in case acts of Providence interfere with compliance.

The cream buyer shall buy according to grades herein defined, shall pay at least one cent differential between contiguous grades and shall post these prices in a prominent place where cream is bought.

At least one sediment test per month shall be run on the cream of each patron.

The State shall license a cream buyer in each place where cream is bought. The licensee shall have proved his ability to the state that he is competent to grade and test cream.

The Dairy Department at South Dakota State College operates with the following grades as specifications:

Grade 1.—Cream which will make butter of 92 score or higher—shall be pure, fresh and clean—acidity not over .20%—fat not less than 30%—free of foreign material—a good clean cream can—not frozen—not over 60°F when delivered. Not over 2 days old in summer or 3 days old in winter.

Grade 2.—Cream which will make butter of 90 score or higher—clean in flavor—not over .5% acidity—fat not less than 25%—not over 4 days old.

Grade 3.—Cream which will make butter scoring less than 90—may have off flavors—onion, oil, yeast, rancid, stale. No acid limit—may have some sediment.

Grade 3 cream is purchased in special instances for class work. Cream of lower grade is not purchased.

A letter from the Dairy Commissioner at Bismack, N. D., dated April 20, 1935, states that a cream grading law failed to pass their legislature. The Commissioners' office will actively support voluntary cream grading with grades defined as follows:

Grade No. 1.—Clean fresh, smooth, free of undesirable odors and flavors—clean to taste either sweet or sour—not excessively sour.

Grade No. 2.—Too sour for No. 1—slight undesirable flavors and odors—slightly lumpy—not pronounced yeasty or cheesy taste—must be clean—may contain can rinsings. All other cream will be rejected as unfit for human consumption.

South Dakota law.—A cream grading law failed to pass the South Dakota legislature. The Divisions of Inspections at Pierre, however, will do all in its power to continue cream improvement. It is now engaged in cream station improvement, planning to grade stations as A, B, and C and eventually to close stations which are not up to standard.

Iowa law.—The Iowa cream grading law specifies cream grades as follows:

Sweet Cream.—Shall be clean to the taste and smell and acidity not to exceed .2%.

First grade cream.—Shall be clean to the taste and smell, smooth, no objectionable flavors and odors and not more than .6% acidity.

Second grade cream.—May have objectionable flavors and odors—is too sour or too old for first grade cream.

Unlawful cream.—Contains dirt, filth, oil or other foreign matter making it unfit for human food or is stale, cheesy, rancid, putrid, decomposed or actively foaming.

At least one cent differential in grade prices shall be paid. Harmless

coloring matter shall be added by the licensed cream grader to unlawful cream.

Minnesota law.—The Minnesota cream grading law defines grades essentially the same as the Iowa law. At least one cent differential is paid and condemnation tags as well as harmless coloring matter are used for unlawful cream.

It will be noticed that the Iowa and Minnesota laws do not include statements about the grade of butter which cream will make. The grades of cream defined by the Canadian laws and the grades described by the State College Dairy Department do refer definitely to the grade of butter which may be expected. It is true that the score of butter may be lower than expected from a certain grade of cream because of faulty manufacture or unsanitary conditions in a creamery. This condition, however, is exceptional. The millers and packing houses buy on basis of grade of flour or meat expected. It is believed that the man who knows quality in cream and butter will definitely use the grade of butter expected when he grades cream, even though the laws make no reference to it. It has been suggested that a cream grading law is more easily enforced if no reference is made to the quality of butter which certain grades of cream should produce, because of the variable conditions of manufacture.

Sediment Test

Sediment tests on cream are run as follows:

- 1.—Use a clean 4 oz. jar to sample the cream when thoroughly stirred. Fill the jar full of cream and it will serve for both the fat test and sediment test.
- 2.—After the fat test, place the cream in the tester—add a few drops of phenolphthalein indicator and slowly add soda ash solution ($\frac{1}{2}$ lb. to 1 gal. water) until a faint permanent pink color remains.
- 3.—Add about 8 oz. of hot water—mix well and filter.
- 4.—Rinse the tester with hot water and force through the pad to free the pad of fat.
- 5.—Thumb tack the pad to a card, placing an identification number under it.

Precaution.—Sample jars, soda ash solution, hot water used for dilution, and the sediment tester, must all be free of sediment. Strain the soda ash solution and the hot water through clean muslin and be sure all sediment is removed.

Note: Sweet cream needs no alkali—merely dilute with the filtered hot water.

Sediment Test for Butter.—The following procedure is recommended by R. P. Meyers and Randall Whittaker and is described in the Feb., 1935 issue of the New York Creamery and Poultry Produce Review Vol. 79 No. 15—page 502.

- 1.—Prepare a solution of either hydrochloric acid (concentrated 1.18 sp. gr.) or of sulphuric acid (concentrated as used in testing milk or cream).
 - A.—for hydrochloric acid 4.5 cc. to 1000 cc of filtered water
 - B.—for sulphuric acid 1.5 cc. to 1000 cc. of filtered water
- 2.—Use a 4 oz. sample of butter.
- 3.—Use 8 oz. of the acid solution.

- 4.—Heat to 160° F. to 180° F. preferably in a water bath and filter.
- 5.—Rinse the filter or sediment tester with clean filtered hot water to free the pad of fat.

The sediment testers used for testing cream can be used for most samples of butter. Some butter may require more force to filter. Sediment testers of the vacuum type or the piston pressure type may be required. Filter discs should be about half the thickness of the common lintine disc used for milk sediment tests. Nainsook, 100 x 100 mesh—strand size 0.006 inches is very good according to the authors.

In comparisons with the borax solution used early in 1934 by the Pure Food Department the acid solutions give more rapid filtering on a greater number of samples. Some samples of butter filtered with difficulty by either method.

Why Cream Tests Vary

Variations in cream tests are sometimes a cause for argument or mistrust of the buyer of cream. To help settle difficulties a review of the factors affecting tests is presented.

1.—The test of the milk directly changes the test of the cream. A cream separator delivers a constant ratio of cream to skimmilk, if conditions of separation are constant. For example, if the cream or skimmilk screw is set so the separator delivers 10 pounds of cream and 90 pounds of skimmilk, the following figures explain the effect of the test of milk on the test of the cream.

Test of Milk	Lbs. Skim	Lbs. Cream	Lbs. Fat	Ratio	Test Cream
4%	90	10	4	4/10	40%
3%	90	10	3	3/10	30%

Here milk does not vary more than .2 to .5% on the average from day to day. According to the figures above, this alone will account for a variation of from 2% to 5% in the cream test.

2.—The position of the skimmilk or cream screw—turning in produces richer cream and vice versa.

3.—Speed of the separator—The higher the speed, the richer the cream and vice versa. The ratio of pounds of cream to pounds of milk is changed.

4.—Rate of inflow to the bowl—Feeding more slowly produces richer cream and vice versa. Feeding slowly produces proportionately less cream. Feeding too fast produces more cream with a lower test.

5.—Temperature of the Milk—Cold milk yields richer cream. The skimmilk will contain considerable fat.

6.—Amount of skimmilk or water used to flush the bowl.

7.—Dipping cream from milk cans before separation (for household use)

Some cream producers have a mistaken notion that sour cream tests higher than sweet cream. This is absolutely erroneous. It is possible that cream kept for several days will test higher due to evaporation of water from the cream. The pounds of butterfat however, will be exactly the same. Less weight with a slightly higher test gives exactly the same total pounds of fat. The producer gains nothing and really loses much. The delay may result in an illegal grade of cream.

Suggested Cream Score Card

No. _____ Date _____	Perfect	Score	Criticism
Name _____	Score	Given	
Flavor and odor	50		
Sediment	25		
Acidity	15		
Container	5		
Test	5		
Total Score	100		
	Judges	_____	_____

This score card is given as a guide in grading cream and with the purpose of encouraging cream grading contests. Cream producers, cream buyers, buttermakers and law enforcement officials should all interest themselves in cream scoring demonstrations and contests.