# Good Flavored Milk

## *A Program for Producer and Processor*

G. H. Wilster
K. A. Jarvis





Agricultural Experiment Station
Oregon State College
Corvallis

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Milk and milk products, to be acceptable to consumers, must have a good flavor and an attractive appearance, and should be of uniform composition from day to day. The keeping quality must be good. The products must be free from undesirable bacteria and foreign matter.

Milk is one of our most nutritious foods; it is consumed primarily because of its food value. Nevertheless, the quantity consumed depends to a large extent upon the flavor of the product. The slightly sweet and pleasant flavor of milk is a principal reason people drink it. Children are especially sensitive to off-flavors in milk. Not only does the flavor of milk affect the quantity consumed in the fluid form, but it influences the quality of the products that are manufactured from it.

The responsibility for furnishing the consumer with milk and milk products of excellent flavor rests upon producer, processor, and distributor. It is more important to have a program of producing milk of fine flavor by better production and handling practices than to emphasize a program of improvement by processing in the milk plants. This does not mean that the necessity of using the best methods of handling the milk in the milk plants can be minimized.

Proper grading of milk on receipt at the plant is the key point in control of the flavor of milk. Nevertheless, the producer himself should make regular and frequent checks on the flavor of milk from his cows. Likewise, the processor and distributor should sample the final product regularly to be assured that the consumer is receiving milk and milk products possessing superior flavor and taste appeal. Consumer comments regarding the flavor of the dairy products are a valuable guide to distributors.

To provide the consumer with wholesome milk having a pleasing flavor, these general recommendations must be followed:

1. Milk must be obtained from healthy cows.
2. Proper feeding and management practices must be followed.
3. Milk from cows that give mastitic, salty, or off-flavored milk should not be used.
4. All equipment with which milk comes in contact must be adequately cleaned and sterilized after each usage.
5. Equipment should preferably be of stainless steel construction; at least it should be well-tinned. There should be no cracks or crevices.
6. Attention must be paid to the temperature of the product--rapid cooling immediately after the milk has been obtained from the cow, storage at a constant low temperature, correct time and temperature during processing, minimum agitation at critical temperatures.

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7. Exposure to light must be prevented, including final delivery to the consumer.
8. Constant precaution must be maintained to avoid contamination of the milk with bacteria, dust, insects, or foreign matter of any kind. Absorption of undesirable odors by the milk must be prevented. The water supply on dairy farms and in milk plants must be pure.
9. Proper selection and rejection of milk at the plant intake must be practiced. Also a daily check of the final product before delivery must be made. The bacterial content must be low.
10. All persons handling the milk must be healthy and clean in their habits.

## The Meaning of the Word Flavor

By flavor is understood a combination of the taste and odor of a substance. There are only four primary tastes; namely, sweet, acid, bitter, and salt. They are determined chiefly by the taste buds located on the tongue, soft palate, and larynx. The sweet taste is primarily determined with the tip of the tongue, the bitter with the rear, the acid with the sides, and the salt with the upper surface of the tongue. Dry substances cannot be tasted. They must be in a liquid or semi-liquid form.

Infinitesimal substances are responsible for the odor. They are determined by the organs of smell. Some of them can be observed by smelling food before it is placed in the mouth, while others are observed when the food is being masticated and swallowed. There are six primary odors: fruity, spicy, putrid, burned, flowery, and resinous. The chemical substances responsible for the odor are volatile and are carried by the air to the olfactory cells located in the nose. There are thousands of chemical compounds that can be smelled.

Examples of desirable odors (or aromas) are those of fruit, coffee, spices, butter, and cheese. Milk of high quality has little odor, especially if it is cold.

The odor of a substance may be undesirable. For example, the odor of rancid fat, putrid meat, decomposed casein.

Garlic flavor is caused by the chemical compound allyl sulfide. The flavor caused by a number of weeds is generally due to the highly flavored essential oils or fatty acids. Feed and weed flavors are generally characterized by the odor of their volatile substances.

The natural flavor of milk is only slightly perceptible. The fat and protein have little direct influence on the taste of milk since only substances which are in solution affect the taste buds. However, milk with a low fat and solids-not-fat content is flat; whereas, where these constituents are present in higher percentage, the milk has a fuller, richer flavor. The natural taste is due primarily to the normal relationship of lactose and chloride in the milk.

The highest quality dairy products are made from milk that has a fine flavor. The addition of a few cans of milk that has a weedy, metallic, bitter, rancid, unclean, or pronounced feed flavor to a vat of fine-flavored milk may have a detrimental effect on the flavor and odor of the products.

# Classification of the Causes of Off-Flavors

1. Flavors caused by feeds and weeds consumed or odors inhaled by the cow.
   Common feeds causing off-flavors include silage, alfalfa hay, turnips, kale, apples, potatoes, beet pulp, beet tops, rape, cabbage, green rye. Common weeds producing off-flavors include wild onion, garlic, tarweed, dog-fennel, bitterweed, wild mustard, Frenchweed, and ragweed.
2. Flavors and tastes caused by the physical condition of the individual cow.
   Conditions which usually result in off-flavors: (a) advanced lactation, (b) infection of the udder, (c) illness of the cow.
3. Flavors which develop as a result of biological, chemical, and enzymatic changes in the milk.
   Biological changes due to the growth of bacteria in the milk are not important if accepted methods are used in the production and processing of the milk. Chemical and enzymatic changes result in oxidized, rancid, metallic, oily-fishy flavors.
4. Flavors which are due to absorption or to contamination after the milk is drawn.
   Neither source of off-flavor is common when proper precautions are taken to produce and handle the milk as previously outlined.

# Causes and Prevention of Common Flavor Defects in Milk

1. Feed flavor

Cause. This is the most common flavor defect of raw milk. Certain feeds, when fed to cows from 1/2 to 5 hours before milking, cause a definite feed flavor in the milk. The flavor, as a rule, is more pronounced in the cream layer. Feed flavor is most noticeable in the spring when the cows receive large quantities of green feed.

Prevention. Feeding flavor-producing feeds immediately after milking is the key method in preventing feed flavor. Cows should not be fed strong-flavored feeds within the last 5 hours before milking. Cows should be prevented from breathing air that has a strong odor of feed. Changes in feeds, especially from dry to green feeds, should be made gradually.

Removal. Strong feed flavor may be reduced in intensity by proper aeration and some slight feed flavors may be eliminated. However, the value of aeration is often over-emphasized. When feed-flavored milk is pasteurized by the usual methods, the flavor will be present in the pasteurized milk. When feed-flavored milk is pasteurized under a partial vacuum, it is possible to almost entirely eliminate the feed flavor. Vacuum treating the milk prior to short-time pasteurization has also been found satisfactory. Work with the Vacreator-vacuum pasteurizer at Oregon Agricultural Experiment Station has indicated that feed flavors could be removed by vacreation.

2. Weed flavor

Cause. Weed flavor of milk is common when weeds are young and succulent during the spring and early summer months. The flavor also may occur during the winter months when hay, containing appreciable quantities of weed forage or seeds, is fed to the cows.

It was demonstrated by specialists of the U. S. Department of Agriculture that the flavor and odor of garlic could be detected in the milk obtained from the cow one minute after garlic was fed. At 10 minutes after garlic was fed the milk had an intense garlic flavor. A strong garlic flavor was present in milk two minutes after cows had inhaled garlic odor during a ten-minute period. When two pounds garlic tops were fed to cows, the odor of garlic was observed in the blood when drawn 30 minutes after the garlic had been fed.

Prevention. To prevent weed flavor in milk, remove the cows from the weed-infested pasture 5-7 hours before milking. In addition, eradicate the weeds.

3. Oxidized-tallowy-cardboard flavor

A flavor resulting from the mild oxidation of protein, fat, and fat-like substances in milk constitutes the most serious flavor problem involved in marketing fluid milk. The flavor varies in intensity according to the stage of its development and the major causative factor.

The flavor may appear in either raw or pasteurized milk. Although the flavor may occur during all seasons of the year, it is most prevalent during the fall and winter months. The cardboardy taste of milk will be transmitted to many food dishes prepared using such milk.

By oxidation is meant:

a. To combine the product with oxygen or the addition of more oxygen.
b. To replace hydrogen in the substance by oxygen.

A. Milk constituents involved when oxidized flavor develops

When the oxidized flavor is induced by copper or certain other metals, the fatty compounds known as phospholipids are oxidized and the resulting products are responsible for the undesirable flavor. Average milk contains about 0.04-.05 per cent of the phospholipids known as lecithin and cephalin. Lecithin contains mainly the fatty acids--stearic acid and oleic acid. The oleic acid is unsaturated and chemically active.

The ascorbic acid (Vitamin C) in milk plays a definite role in the development of oxidized flavor. In most cases, ascorbic acid aids in the development of the flavor. Factors which accelerate the development of the flavor and the rate of oxidation of ascorbic acid seem to have a general relationship. However, ascorbic acid may exert an inhibitory influence under certain conditions.

B. Causes of oxidized flavor in milk

1. The individuality of the cow. The milk from certain cows may be more susceptible to the development of oxidized flavor than that of others. It has been shown that an oxidized flavor may develop in the milk obtained from certain individual cows when the milk has not come in contact with any metal or catalytic agent. This is known as the "spontaneous" type of oxidation. When this milk is mixed with the balance of the milk produced by the herd, all the milk may have an oxidized flavor.

The milk from some cows is susceptible to metal-induced oxidation; whereas some cows produce milk that is rather resistant to metal-induced oxidation. The breed of the cow and the age of the cow appear not to influence the occurrence of oxidized flavor. There is little agreement on whether the susceptibility of milk varies with the period of lactation.

2. The feed consumed by the cow. It has been observed that a change from a ration that consists primarily of dry feeds to a ration that contains considerable succulent feeds, such as pasture, aided in overcoming this defect when present in the milk. The increased susceptibility of winter milk to oxidized flavor development as compared with summer milk has been ascribed to the lower antioxidant content of the dry rations common to winter feeding of cows. Vitamins C and E are known to possess anti-oxidant properties. Simply a change of feed has been found to be beneficial in some instances.

3. The presence of oxygen in the milk. There is practically no dissolved oxygen in milk as it is drawn from the cow. During production and processing, oxygen is added to the milk with the result that milk ready for final delivery contains approximately 10 to 12 milligrams per quart. The oxidation potential is increased, thus the tendency to oxidize is increased.

4. The effect of metallic contamination. Copper and iron and certain metal alloys containing copper, such as nickel silver, bronze, monel metal, etc., when in contact with milk may react with the milk to form metallic salts. These salts act as catalysts; that is, they effect a change in some of the milk constituents. They are responsible for oxidation of some of the constituents of the milk and giving rise to an oxidized-tallowy-cardboard flavor.

   Copper is the most active of the metals. The exposure of the milk to a small copper or copper alloy surface, as for instance to a short length of pipe, a copper thermometer bulb, a surface cooler, or to a coil that shows exposed copper, is sufficient to cause oxidation. Homogenization increases the tolerance of milk to copper contamination practically ten times. The metallic salts formed when milk dissolves these metals often produces a metallic flavor. This flavor is usually the forerunner of an oxidized flavor. Copper-induced oxidized flavors develop slowly--after hours or days in cold storage.

   Stainless steel, tin, aluminum, and glass enamel are nonreactive with milk and cream.

5. Number of bacteria in milk. Oxidized flavor is more common in milk containing only a few bacteria than in milk that contains a large number. In low-count milk there is little utilization of oxygen by the bacteria; hence, there is a greater opportunity for oxidation of certain milk constituents. The production of high-count milk, or the addition of bacteria, or certain antioxidants, are definitely not methods to use for control.

6. Pasteurization. Pasteurization itself has little effect on the development of oxidized flavor. Even so, metals are more soluble in warm milk; hence, indirectly, pasteurization may aid the development of the flavor by increasing the amount of metallic contamination.

   Milk may develop an oxidized flavor even when pasteurized in glass or in other non-metal containers. Such development is referred to as being "spontaneous." There is no known prevention except perhaps to change the feed of the cows.

7. Exposure to light. The exposure of milk for only a short time to direct sunlight, or even daylight, favors the development of a tallowy-cardboard flavor. The flavor of homogenized milk is more easily damaged by sunlight or bright light than the same milk non-homogenized. The development of light-activated oxidized flavor is a major problem in the distribution of fluid milk to the consumer.

   Sunlight is destructive to the ascorbic acid (Vitamin C) and riboflavin (Vitamin $B_2$) in the milk.

   The photo-chemical reactions which produce oxidized flavors are not fully understood. They appear to be different, especially with homogenized milk, from the reaction which produces the more common oxidized flavor. Thus, the methods used to prevent one type of oxidized flavors do not prevent the other.

   Milk in bottles, especially clear glass, should never be unduly exposed to sunlight, either when direct or when partly obscured by clouds or haze.

C. A test to use in the control of oxidized flavor

1. Fill three one-pint bottles three-fourths full with the milk to be tested.
2. Use one bottle of milk as a control. Pasteurize the two others in a water bath at 143° F. for 30 minutes and cool to 50° F. To one bottle of pasteurized milk add 3 ml. of copper sulfate solution prepared by adding 100 milligrams copper sulfate to one liter distilled water. Approximately 0.25 parts per million of copper will be added to the milk. Keep the other bottle of pasteurized milk as a control.
3. Store the three samples at 40° F.
4. After 2 or 3 days examine each sample for flavor.
5. If no oxidized-tallowy flavor has developed in the milk that contains no added copper but if it develops in the milk which contains copper, the milk is susceptible to the development of the defect when copper-exposed equipment for milk handling is used.

   Instead of adding 3 ml. of copper solution, 6 ml. may be added. If no oxidized-tallowy flavor develops during storage the milk is little susceptible to the development of the defect.

Prevention of oxidized flavors. To prevent oxidized-tallowy-cardboard flavor in market milk, observe the following.

1. Determine the susceptibility of the milk in each vat of milk pasteurized in the milk plant to the development of the oxidized defect.
2. If necessary test also for susceptibility the milk furnished by each producer. Eliminate the milk from cows whose milk quickly oxidizes.
3. If possible add more succulent feed to the cows' ration. Simply a change in the feed may be helpful, too.
4. On the farms, use utensils that are free from exposed copper, iron, or copper-bearing alloys.
5. Recondition utensils that show rust spots and copper.
6. Do not expose milk to sunlight or strong daylight.
7. In milk plants, be sure all copper and iron surfaces are covered with a good coating of tin. This includes pumps, bearings, pipes, pipe fittings, thermometer bulbs.
8. Do not expose milk to copper-bearing alloys. Use stainless steel or aluminum for dairy equipment, or if copper is used, be sure that all parts are covered with a heavy coating of tin.

4. Rancid flavor

Cause. Rancid flavor in milk may be the result of: (1) spontaneous or (2) induced lipolysis (breakdown of the butterfat) by a chemical substance. This chemical substance--the enzyme lipase--is present in varying amounts in the milk when it is drawn from the cow.

The susceptibility of milk to the spontaneous development of rancidity varies with the individuality of the cow, the season, the stage of lactation, and the feed the cow consumes. Agitation of susceptible raw milk before cooling is sufficient to start lipase activity. Cows in advanced lactation, on dry feed, or with infected udders are most likely to produce milk that will develop spontaneous rancidity.

Induced lipolytic rancidity may be caused by (a) contamination of homogenized pasteurized milk with raw milk or the homogenization of raw milk, (b) warming cold raw milk to about 86° F. and cooling again below 50° F., and (c) prolonged or violent agitation of warm milk which has not been heated to the temperature (130° F. or above) which will inactivate the enzyme lipase.

Rancid flavor has several degrees of intensity. One of these degrees is the salty flavor of milk from cows in an advanced stage of their lactation. A rancid-bitter flavor may develop in the milk when this is stored for some time. The flavor is more pronounced in the cream. Pasteurization will not eliminate the rancid flavor but the heating process destroys the chemical substance involved in the production of the flavor. The characteristic rancid flavor is attributed to the volatile fatty acids (butyric, caprylic, capric, and caproic) which are produced when lipase breaks down butterfat.

Certain types of bacteria produce lipase. Thus, indirectly, bacteria may be the cause of rancidity.

Homogenization of whole milk at a temperature from 80° to 120° F. has been found to be the temperature zone that would result in a definite rancid flavor of the milk upon standing. A homogenization temperature of 20° F. below or above these

temperatures also resulted in the development of rancid flavor and accompanying increase in acidity. When homogenized at temperatures from 80° to 120° F. and the milk cooled and held at below 40° F., a definite rancid flavor appeared in the milk after 2 hours. There is no advantage so far as the flavor of the pasteurized milk is concerned in homogenizing before or after pasteurization. A temperature of 130° F. at which to homogenize before pasteurization involves less risk from rancid flavor development in the event of a delay of pasteurization. Homogenization prior to pasteurization is preferred from a sanitary point of view.

Prevention. It is possible to prevent the development of rancid flavor by exercising care in the production and handling of the milk.

1. Make frequent tests of the milk from each cow, especially those late in their lactation.
    a. Obtain a sample from each cow.
    b. Store in a sterile glass bottle for 48 hours at 40 to 50° F.
    c. Warm to 100° F. and note the odor and flavor.
    d. Dry off cows whose milk turns rancid after storage for 48 hours.
2. Do not use milk that is salty.
3. Do not use milk from infected udders.
4. Cool milk rapidly immediately after milking.
5. Avoid fluctuation in the temperature of the milk.
6. Avoid shaking or agitation of milk, especially when above 86° F.
7. Do not contaminate homogenized milk with raw milk.

5. Salty flavor

Cause. This taste is frequently present in milk from cows that are late in their lactation period or in milk obtained from a diseased udder. It is due to a change in the natural chloride-lactose balance of the milk.

Prevention. The only remedy for this defect is to dry up the cow.

6. Cooked flavor

Causes

a. Pasteurization temperature too high.
b. Temperature of heating medium too high.
c. Insufficient agitation of milk during heating with vat method.
d. Rate of flow of milk through short-time pasteurizer too slow.
e. Deposit of milkstone on heating surface.
f. Holding milk too long at pasteurization temperature.
g. Inaccurate thermometers.

Prevention. The responsibility for the prevention of a cooked flavor is entirely that of the pasteurizer operator. Constant attention must be given to the following items:

a. Keep equipment free from milkstone.
b. Operate the pasteurizer correctly.
c. Maintain a proper temperature of heating medium.
d. Use tested thermometers—check their accuracy frequently.

7. Old flavor

An old, stale flavor generally develops in milk pasteurized by the usual method when kept at ice box temperature for several days. The milk may show no increase in acidity. The old flavor of milk may develop into rancid flavor.

8. Unclean flavor

Cause. An unclean flavor may be characterized as a very unpleasant flavor suggestive of being caused by a combination of milking unclean cows in a dirty barn, using either dirty hands or an unclean milking machine, using poorly cleaned, foul-smelling utensils, and straining the milk through a dirty strainer cloth.

The inhalation of strong-smelling air by the cows may result in milk of an objectionable flavor. If the cows are allowed to breathe foul-smelling air the milk may have an undesirable, unclean flavor.

This flavor, if present in the raw milk, will also be present in the pasteurized milk.

Prevention. To avoid the flavor it is necessary to use sanitary methods during the production and handling of the milk. Single-service filter pads should be used. The milking should be in a well-ventilated barn or milking parlor. Use properly cleaned equipment in both the production and the processing of the milk.

9. Sour flavor

There is no market for sour milk.

Cause. This flavor is the most common of several flavors (malty, tainted, fruity, or musty) which result from bacterial action in milk. Among the more prevalent factors affecting the contamination with and growth of bacteria in milk are the following:

a. Allowing the milk to come in contact with improperly cleaned and sterilized equipment.
b. Storing the milk too long at a temperature favorable for the growth of bacteria ($60^{\circ}$ to $100^{\circ}$ F.).
c. Incorrect pasteurization.
d. Use of sour-smelling milking machines, strainers, or cans.
e. Failure to reject sour milk at the plant intake.

Prevention

a. Keep dirt out of milk.
b. Use only properly cleaned and sterilized equipment.
c. Cool milk immediately after milking to a low temperature ($40^{\circ}$ to $50^{\circ}$ F.).

d. Keep milk cold during storage and shipment.
e. Use the proper temperature and holding time for pasteurization.
f. Pasteurize the foam if the vat method is used.
g. Use accurate thermometers.
h. Use clean, sterilized bottles.
i. Cool the milk to 40° F. or below immediately after pasteurization and keep it at 35° F. until it is sold.

10. Foreign flavor (gasoline, medicine, turpentine, disinfectant)

Cause. If milk cans or other utensils have been used for gasoline, turpentine, or kerosene, the flavor of the milk is generally so bad that the milk cannot be used for human consumption. It is practically impossible to remove the odor from the cans. The milk, if placed in such cans, will invariably possess an undesirable taste from the materials. If such milk is used it may taint the balance of the milk placed in the milk plant supply tank.

Medicinal flavors, suggesting iodine and carbolic acid, have been observed in milk. The feeding of seed grain preserved with paradichlorbenzene was found to give an objectionable foreign, medicinal flavor to milk. Certain types of bacteria may produce a medicinal flavor. Milk will absorb strong flavors, particularly those that dissolve in fat, such as kerosene or disinfectant.

Prevention. To prevent the flavor, never use milk cans or pails for gasoline or kerosene or other similar products. Avoid using strong smelling fly spray immediately before or during milking time. Do not use soap for washing utensils. Use an alkaline cleaner. For chemical sterilization of utensils, do not use a coal-tar disinfectant. Use approved chemical sterilizing compounds. If ointment is used on cows' teats, be sure that none of this comes in contact with the milk.

11. Barny flavor

Cause. The major causes of barny flavor is inadequate ventilation of the barn and physical contamination of the milk. Absorption of the odors in a barn by the milk itself is seldom the cause of this flavor. However, warm milk in an atmosphere saturated with odors will absorb those odors in a relatively short time. Milk from dirty cows housed in a poorly cleaned and insufficiently ventilated barn and milked by a producer who has dirty hands and clothes will have a pronounced barny flavor. Some of the dirt will fall into the milk. In addition there are certain bacteria naturally found in manure that may produce the flavor in milk if they have been introduced into the milk and allowed to multiply in it.

Prevention. It is unnecessary to go into details regarding the prevention of the flavor. Briefly, it means:

a. Clean and well-ventilated barns and milking parlors.
b. Clean cows with hair close-clipped.
c. Clean hands and clothes.
d. Clean equipment.
e. Removal of the milk from the barn as soon as it has been obtained from the cow.

12. Bitter flavor

Cause. This flavor may be due to (1) certain feeds consumed by the cow, (2) bacterial action, or (3) lipase action on butterfat.

Prevention. The methods outlined for the prevention of feed and rancid flavor apply in this case. The prevention of bacterial contamination is accomplished only by the practice of adequate cleaning and sterilization of all equipment and the protection of the milk at all times.

## Identification of Flavor in Milk

The method of determining flavor by tasting and smelling the milk is highly efficient. Nearly all people have the native ability to identify flavor in milk by means of taste and smell. Even so, accuracy in the identification of flavors is achieved only by practice and by careful attention when examining a sample.

An experienced judge or grader will first smell, then taste the sample. He makes a mental comparison between the sensations noted and his mental concepts of desired standards. The actual time required to identify the taste of a sample is relatively short. It has been found to vary from 3 to 8 seconds. Off-flavors are identified more quickly than excellent flavor.

A temperature of about 70° F. is most suitable for the rapid and accurate identification of flavors in milk and cream. However, only a few flavors would pass an experienced grader who is grading grade A milk which must reach the milk plant at 50° F. or lower.

## Grading Milk

Method of Scoring Milk
(American Dairy Science Association)

FLAVOR AND ODOR--PERFECT SCORE, 45

Deductions for disagreeable or foreign odor or flavor should be made according to conditions found. The following may be used as a guide in scoring for flavor:

| | | |
|---|---|---|
| Excellent: | 40-42 | score; no criticism. |
| Good: | 37-40; | lacking special fine flavor, flat, very slight feed, slightly cooked. |
| Fair: | 34-37; | cooked, feed, salty, slightly cowy, slightly oxidized, slightly old. |
| Poor: | 25-34; | strong feed, weedy, bitter, musty, cowy, oxidized, slightly rancid, stale. |
| Bad: | 0-25; | rancid, cowy, high acid, definitely stale, tallowy, sour, or any flavor sufficiently strong to render the milk unfit for market milk purposes. |

## SUGGESTED SCORES FOR MILK FLAVOR DEFECTS OF VARYING INTENSITIES

| Flavor criticism | Score for flavor when the intensity of the defect is: | | |
|---|---|---|---|
| | Slight | Distinct | Pronounced |
| Feed | 37-39½ | 35-37 | 30-35 |
| Flat | 39-39½ | - | - |
| Cooked | 38-39½ | 35-38 | 30-35 |
| Salty | 32-35 | 30-32 | 25-30 |
| Oxidized, tallowy | 30-35 | 25-30 | 10-25 |
| Unclean | 30-35 | 25-30 | 15-25 |
| Cowy or barny | 30-35 | 25-30 | 20-25 |
| Malty | 30-35 | 30 | 25 |
| Musty | 25-35 | 25 | 20 |
| Bitter | 30-35 | 25-30 | 20-25 |
| Old, stale | 25-35 | 25 | 15 |
| Metallic | 30 | 25 | 10 |
| Weedy | 25 | 10 | 0 |
| Foreign | 15 | 0 | 0 |
| Rancid | 25-30 | 0 | 0 |
| Garlic or onion | 0 | 0 | 0 |
| Acid or sour | 0 | 0 | 0 |
| Putrid | 0 | 0 | 0 |

## BACTERIA PER MILLILITER--PERFECT SCORE, 35

| Count | Points | Count | Points | Count | Points |
|---|---|---|---|---|---|
| 500 and under. | 35.0 | 11,100-12,000... | 32.7 | 36,000- 40,000.. | 25.6 |
| 510- 1,000.... | 34.9 | 12,100-13,000... | 32.5 | 41,000- 45,000.. | 24.1 |
| 1,010- 1,500.... | 34.8 | 13,100-14,000... | 32.3 | 46,000- 50,000.. | 22.6 |
| 1,510- 2,000.... | 34.7 | 14,100-15,000... | 32.1 | 51,000- 55,000.. | 20.6 |
| 2,010- 2,500.... | 34.6 | 15,100-16,000... | 31.9 | 56,000- 60,000.. | 18.6 |
| 2,510- 3,000.... | 34.5 | 16,100-17,000... | 31.7 | 61,000- 65,000.. | 16.6 |
| 3,100- 3,500.... | 34.4 | 17,100-18,000... | 31.5 | 66,000- 70,000.. | 14.6 |
| 3,600- 4,000.... | 34.3 | 18,100-19,000... | 31.3 | 71,000- 75,000.. | 12.6 |
| 4,100- 4,500.... | 34.2 | 19,100-20,000... | 31.1 | 76,000- 80,000.. | 10.6 |
| 4,600- 5,000.... | 34.1 | 20,100-21,000... | 30.9 | 81,000- 85,000.. | 8.6 |
| 5,100- 6,000.... | 33.9 | 21,100-22,000... | 30.7 | 86,000- 90,000.. | 6.6 |
| 6,100- 7,000.... | 33.7 | 22,100-23,000... | 30.5 | 91,000- 95,000.. | 4.6 |
| 7,100- 8,000.... | 33.5 | 23,100-24,000... | 30.3 | 96,000-100,000.. | 2.6 |
| 8,100- 9,000.... | 33.3 | 24,100-25,000... | 30.1 | Over 100,000.... | 0 |
| 9,100-10,000.... | 33.1 | 25,100-30,000... | 28.6 | | |
| 10,100-11,000.... | 32.9 | 31,100-35,000... | 27.1 | | |

## SEDIMENT--PERFECT SCORE, 10

Examination for sediment shall be made if possible by means of a sediment tester, and the resulting cotton disks compared with standards. Use a magnifying glass. When possible, the nature of the sediment should be described.

## TEMPERATURE--PERFECT SCORE, 5

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

## CONTAINER AND CLOSURE--PERFECT SCORE, 5

Make deductions in score for dirty, leaky, dented, or chipped containers, and for closures which do not cover the lips of the containers or do not fit properly in the closure seats.

# Milk Score Card

Date_____

(Examples shown under 1 and 5)

Write scores on lines which show maximum score. Check criticism in space opposite the defect noted and in proper sample column.

| Perfect score | Criticisms | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flavor (45) | No criticism 40-45<br>Normal range 30-40 | 40 | | | | 38.0 | | | | | |
| | Acid or sour | | | | | | | | | | |
| | Bitter | | | | | | | | | | |
| | Cooked | | | | | | | | | | |
| | Cowy or barny | | | | | | | | | | |
| | Feed | | | | | ✓ | | | | | |
| | Flat | | | | | | | | | | |
| | Foreign | | | | | | | | | | |
| | Garlic or onion | | | | | | | | | | |
| | Malty | | | | | | | | | | |
| | Metallic | | | | | | | | | | |
| | Musty | | | | | | | | | | |
| | Old, stale | | | | | | | | | | |
| | Oxidized | | | | | | | | | | |
| | Rancid | | | | | | | | | | |
| | Salty | | | | | | | | | | |
| | Unclean | | | | | | | | | | |
| | Weedy | | | | | | | | | | |
| Sediment (10) | Normal range 8-10 | 10 | | | | 9.5 | | | | | |
| Container and closure | No criticism 5<br>Normal range 3-5 | 5 | | | | 4.5 | | | | | |
| | Closure | | | | | | | | | | |
| | Cover torn | | | | | | | | | | |
| | Not sealed | | | | | | | | | | |
| | Poorly seated, or leaky | | | | | | | | | | |
| | Container | | | | | | | | | | |
| | Dented | | | | | | | | | | |
| | Leaky | | | | | | | | | | |
| | Not clean inside | | | | | | | | | | |
| | Not full | | | | | ✓ | | | | | |
| | Pouring lip | | | | | | | | | | |
| | Chipped | | | | | | | | | | |
| | Cover not waterproof | | | | | | | | | | |
| | Not protected | | | | | | | | | | |
| | Partly protected | | | | | | | | | | |
| Bacteria (35) | | 35 | | | | 34.5 | | | | | |
| Temperature (5) | | 5 | | | | 5.0 | | | | | |
| Total (100) | Total score of each sample | 95 | | | | 91.5 | | | | | |