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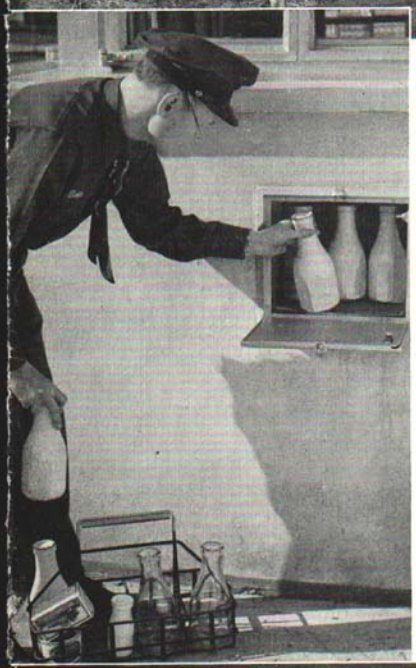

PRODUCING QUALITY MILK

By Earl Weaver and J. M. Jensen

MICHIGAN STATE COLLEGE
COOPERATIVE EXTENSION SERVICE
EAST LANSING

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Nearly 30 percent of all the milk produced in the United States is consumed by urban residents as fluid milk and cream. Millions of families in cities, towns, and villages buy all the milk they use. Also many individuals obtain their meals in hotels, restaurants, cafes, and boarding houses. These people constitute the market for the fluid milk business, and they pay a premium for this milk over what it would bring if sold for any other purpose. These city consumers impose definite demands for a product of high quality and it is logical that dairy producers should heed these demands.

NEED FOR REGULATION

Most dairy farmers are entirely ethical and dependable in assuming the responsibilities imposed on them as producers of milk, but it is conceivable that some dairyman might be careless in his methods and thus impair the quality of his product. The nature of milk makes it especially susceptible to contamination. Because consumers recognize the possible hazard in a milk supply and realize that they are in no position as individuals to observe production methods and inspect the milk, they have established regulations and enforcing agencies in most cities to safeguard their interests. Justice in their attitude on this matter must be acknowledged by all dairy producers.

WHAT CONSUMERS EXPECT IN REGARD TO QUALITY

In evaluating the milk quality, consumers give consideration to the following five points: flavor, cleanliness, keeping quality, safety, legal composition. Milk must have a desirable flavor. Cleanliness is also demanded. Not only must the milk be free of visible foreign matter, but a housewife wants assurance it has never been exposed to contamination. Good keeping quality is another requirement. Milk that sours too quickly or that develops other off-flavors is discredited.

The most urgent demand of most consumers is that the milk be

safeguarded against all hazards to human health. Such safeguards are the chief objectives of all inspection agencies. Consumers also expect that the milk complies with legal standards for fat and solids. But consumers' judgment on this question is not always valid. Too often they become suspicious that milk has "too little cream". They can be assured that milk which fails to meet the required fat percentage is seldom offered for sale.

COMMON TESTS FOR MILK QUALITY

Several tests may be used by dairy inspection agencies or dairy plants to determine the quality of the milk offered for sale by a producer. These include flavor, temperature, fat percentage, percentage of solids-not-fat, sediment, methylene blue, standard plate count and direct microscopic count. So far as known, no city or market uses all these tests. Certain ones are especially favored and used in some markets; in other markets some of the other tests are used.

The one test used universally is the determination of the fat content because milk and cream are purchased on this basis. Likewise,

Fig. 1. A final check on milk quality is the tests made at the "platform" when milk is delivered. At left, the inspector takes the samples for his tests. The men who weigh and empty the cans also take tests and examine the milk for flavor.

Fig. 2. But the inspection service does not restrict its attention only to the tests on milk. Here an inspector in his visit to a farm inspects the milk house and gives close attention to the utensils—their construction, state of repair and especially their cleanliness. Proper attention to utensils is a big step in quality milk production.

as producers sell milk, it is tasted regularly or at periodic intervals at the receiving platform to determine its flavor. At intervals the dairy plant and the inspection service make other tests. The temperature of each can of milk is determined. Michigan law stipulates that milk shall be at a temperature of 60° F. or lower when received from the producer. Various cities may have different temperature demands. The sediment test is also usually run to ascertain if the milk contains any visible foreign material.

The last three tests are made to determine the number of bacteria. The methylene blue test is often called the reductase test and is used as a cheap, quick test to reveal the approximate number of bacteria. The standard plate count is a more precise but more costly and time-consuming test which is not widely used. The direct miscroscopic count is usually a more popular test, not only to determine numbers of bacteria, but also to reveal the types present and is thus helpful as an indication of the sources from which milk may have been contaminated.

BACTERIA IN MILK

Any dairy farmer who succeeds in producing quality milk must have some knowledge of bacteria. He must realize that their number is an indication of milk quality. Excessively high numbers signify there are some faults in the methods or equipment used in the dairy. As milk is drawn from the udder of a clean healthy cow it contains some bacteria, but the number is seldom more than 1,000 to 1,500 per milliliter. As soon as the milk is drawn it may be contaminated through carelessness in milking or from utensils if they have not been properly treated. Then the bacteria multiply enormously if the milk is not promptly and effectively cooled.

Most of the bacteria in milk are harmless types that do not produce any disease condition in human beings. However, under certain conditions disease-producing types may occur. Because of this possibility, especial care must be exercised that only healthy cows are kept in the producing herd. Filth about the premises must be avoided, and no person must be permitted to milk or handle the utensils if he is afflicted with any communicable diseases.

SOURCES OF BACTERIA IN MILK

Most of the regulations that are established for producing quality milk are directed toward those procedures that will avoid contamination of the milk with bacteria. It is essential that dairy producers recognize the sources from which contamination may come. Then the dairyman will find that his chief opportunities in producing quality milk lie in handling his cows, the premises, the utensils, the milking procedures and the milk itself so that excessive bacterial contamination cannot occur. There are five possible sources from which bacteria may enter milk: 1) The interior of the udder, 2) the exterior of the cow's body, 3) dust or flies in the barn or milk room, 4) utensils, and 5) the person doing the work.

HEALTHY COWS—AN ESSENTIAL

Three disease of cows—tuberculosis, Bang's disease, and mastitis—are of concern from the standpoint of milk quality. Dairymen are universally required by law to have their cows tested for tuberculosis and to dispose of any reacting animal. This disease is almost completely eradicated among Michigan cattle. Bang's disease, or infectious abortion, is a more serious problem. While dairymen are not universally compelled to test their cows for this disease, such tests should be made

regularly and the milk from any reacting cows should be excluded from sale.

Mastitis, or garget, is the most prevalent of the three diseases. This disease may occur in an acute or chronic form. The former is readily detected by the general disorder in the cow and the distress she exhibits. The chronic cases are more difficult to detect. Since an infected cow may cause a serious outbreak, any suspicion of mastitis should be ample reason for the testing of the entire herd. Several different tests for mastitis have been devised. The particular one to use can best be determined upon advice from a veterinarian.

USE OF A STRIP-CUP

A particular advantage in the use of a strip-cup is that it reveals many cases of abnormal milk and is thus an aid in detecting mastitis. Its use is especially urgent when the cows are milked by machine for it affords the operator his best chance to examine the udder. With the information thus secured the abnormal milk can be discarded, the cow properly handled, and the machine not used on her, thus avoiding possible infection of subsequent cows.

Another argument for use of a strip-cup is based on the fact, that the first few streams of milk from each teat are invariably contaminated with bacteria. If this fore-milk is drawn into a strip-cup, so that it may be discarded and not included with the regular milk, there is a reduction of the bacteria

Fig. 3. A strip-cup is a material aid to quality milk production, especially when a milking machine is used. The first few streams from each teat are milked into the cup and then discarded in the gutter—not on the stall floor. Special cups with wire gauze can be purchased or use can be made of any cup with a cloth —preferably black—stretched over the top and held in place by a rubber band.

Fig. 4. Clean cows in a clean, well-bedded, well-lighted barn. Note that the cows are properly clipped for quality milk production. With the clippers, a line is run from the pin bone to the milk well on each side of the cow. All long hair below this line—except the switch—is clipped once or twice each winter.

count of the milk that is sold. This fore-milk comprises a quite insignificant quantity and is virtually devoid of fat, so the discarding of it does not reduce the income from the cow.

ONLY CLEAN COWS CAN PRODUCE CLEAN MILK

Clean stables are necessary if the cows are to be kept in suitable condition to produce quality milk. The stable floors must be of concrete. Proper dimensions for stalls, gutters and alleys are important because over-crowding must be avoided. Usually about 400 cubic feet of space is desired for each cow in a stable. Ample lighting through windows also contributes to cleanliness. About 3½ square feet of window area is desired for each 100 square feet of floor area. The gutters in the stable must be cleaned regularly before milking and the cows properly bedded. Approximately a ton of bedding is required annually for each cow.

Clean lots make it possible to keep the stables and the cows clean. A lot with a south slope is ideal. Too often the barn lot is a quagmire and the cows are not only dirty, but their milk is likely to be contami-

nated with those bacteria that cause disease, ropiness and off-flavors. Manure that accumulates in the lots should be hauled out frequently. This not only contributes to the cleanliness of the premises but is an aid in controlling flies through the removal of their chief breeding places.

Currying the cows regularly is a necessary procedure though often neglected. It removes the loose hair and scurf that would otherwise contaminate the milk, and it prevents the accumulation of filth on the cow's body, flanks, udder, legs and tail.

Clipping the cows to remove the long hair on the flanks, udder, underline, tail and rear legs is another useful step in clean milk production though it may not always be feasible unless a power clipper is available. When a cow is properly clipped she does not collect filth so readily; she can also be more effectively curried or brushed. It is found that clipping in December removes the long growth of hair that comes with cold weather. By February, another clipping is desired. Then by the time the hair has grown long the spring shedding has begun. In the summer the hair is shorter, and clipping is unnecessary.

Washing the udder with a chlorine solution (200 parts per million) and at a temperature of 125° F. is quite common practice to induce the "let down" of milk just before the milking machine is attached. The practice also has great value in producing quality milk. It settles the dust, hairs and scurf so they are not dislodged into a pail during milking. It also destroys some bacteria and helps to keep the milker's hands sanitary. Cows so handled have fewer cases of cowpox and other superficial udder troubles.

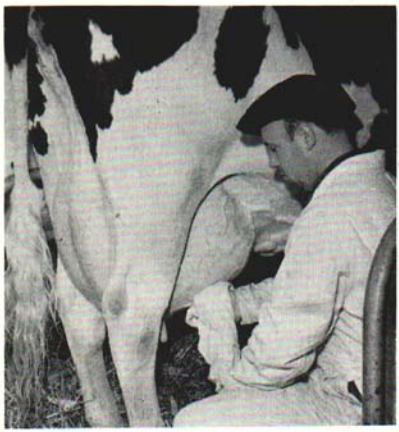

Fig. 5. Though the cow is apparently clean, before milking is started her udder should be wiped with a clean cloth moistened in a chlorine solution.

Washing cows is seldom necessary because they should be kept clean. But if a cow is so badly soiled

that currying cannot accomplish proper cleaning she must be washed. Then the teats and udder must be dried to avoid chilling and to remove excess drops of contaminated water that would fall into the milk.

CLEAN, CAREFUL, HEALTHY DAIRY WORKERS

The persons who do the milking and handle the milk and the utensils must wear clean clothes while performing the dairy work. Cleanliness and care in the procedure during milking are necessary. A careless, slovenly person can ruin every effort otherwise made to produce quality milk. The hands should be washed at the start of milking and as often thereafter as necessary. Wet hand milking is always objectionable. The milker must exercise every care that the pail of milk is not contaminated from himself, from the cow being milked or from adjoining cows. No person should handle milk in any way if he is afflicted with any communicable disease or if he is associated with diseased persons.

SMALL-MOUTH PAILS

Even with greatest care, some contamination of milk is always possible during the actual milking. A small-mouthed pail is an extra safeguard. Through its use the number of bacteria that contaminate the milk is only a third to a half as great as with the open-top pail.

CARE OF UTENSILS THE MOST IMPORTANT POINT

It has been found that under usual methods in caring for utensils, more bacteria find their way into milk from this source than from any other. These bacteria that come from utensils are seldom of a type that is serious from the standpoint of disease but their great numbers signify faulty methods and impair the quality of the product.

There are four steps to be observed in properly caring for milk utensils:

1. RINSING IN COLD WATER

Milk film that forms during use should be washed from utensil before it has time to dry. This is best done with clean, cold water, or cold water to which a small amount of "wetting agent" is added. A soft hair, bottle brush is found useful for applying the rinse water over the entire surface of utensils. They are then ready for washing.

2. WASHING IN WARM WATER WITH A BRUSH AND DAIRY CLEANSER

The water for washing should be at a temperature of 115°-120° F. A dairy cleanser must be used to remove the milk residue. Special cleansers have been developed that are very useful. These consist of "wetting agent" and near neutral water softening salts. Their special advantages lie in discouraging milk stone and providing rapid and very complete cleaning. More complete draining of wash water is secured and they have been usefully applied in flush washing methods for cream separators and milking machines.

3. RINSING IN HOT WATER

This is a most important step in utensil cleaning. Three very essential functions should be accomplished: 1) all traces of wash water should be removed, 2) bacteria that are lodged in utensil pores and crevices should be destroyed, and 3) metal utensils should absorb sufficient heat to cause rapid and complete drying after washing.

While wash vats are made with compartments for rinsing, some utensils, such as milker parts, are best rinsed by drawing the hot rinsing water through milker units following washing and reassembly.

4. TREATING TO KILL BACTERIA

This procedure is variously designated by different terms as sterilization, sanitizing and bactericidal treatment. Even after thorough washing, milk utensils carry great numbers of bacteria. To destroy these bacteria, hot water, steam

Fig. 6. Steam cabinet with doors ajar. Utensils here are effectively treated at 170° F. for 15 minutes. The heat then dries them promptly. They are protected here till the next morning.

Fig. 7. The insulated concrete tank is most widely used in cooling milk. This dairyman has a device for conveying the cans of milk into and out of the tank. Note also his home-made can rack.

or a chemical may be used. For the hot water to be effective it must be at a temperature of at least 170° F. with the utensils submerged for at least 2 minutes. Immersion in boiling water for 2 minutes accomplishes the purpose. Steam is also frequently used. Farm type "sterilizers" may be procured. In a steam cabinet the utensils must be exposed for 5 minutes at 200° F. or 15 minutes at 170° F. If the utensils are inverted over a jet they must be exposed to the direct steam for at least one minute.

Chemical sanitizing agents are used where facilities for abundant hot water or steam are not available. These agents are not as reliable for germicidal purposes as hot water, but may be used quite successfully with proper application.

Chlorine solutions may be employed for rinsing equipment shortly before it is put into use. Chlorine solution should not be used for continuous storage of rubber parts because of its deteriorating action on rubber. For ordinary rinsing of equipment a chlorine solution strength of 100 parts per million is satisfactory.

Lye solution at 0.4 to 0.5 percent strength is recommended for use in rubber inflations and tubings of milking machines. Best results are secured when its use is confined to solution rack storage and fresh solution is applied at each storage period. Boiling milker rubber parts in strong lye solution over a 15-minute period (2 ounces lye per gallon water) is found to extract fat from rubber and to destroy bacteria that are harbored within the rubber pores. This treatment is found effective in remedying causes of high thermoduric counts. Any container that offers protection to the rubber parts by means of a screen or other barrier, so the rubber is not in intimate contact with the hottest portion of the container, is satisfactory.

COOLING MUST NOT BE NEGLECTED

The number of bacteria found in milk is dependent first, upon the number that have gained entrance into the milk and second, upon the rapidity with which they have multiplied. At a temperature of 70° F. the number of bacteria in milk will double every half hour and, thus, within a short period reach stupendous figures. Lower temperatures arrest this growth.

It is usually specified that milk be cooled to 60° F. or lower immediately after milking and held there until delivered to the milk plant. Even 50° F. or lower makes for higher quality milk. Cold water must be used to accomplish the cooling. Usually in Michigan the water is below 60° F. and is satisfactory though in some cases ice is necessary. Air, even at sub-zero temperatures, is not effective.

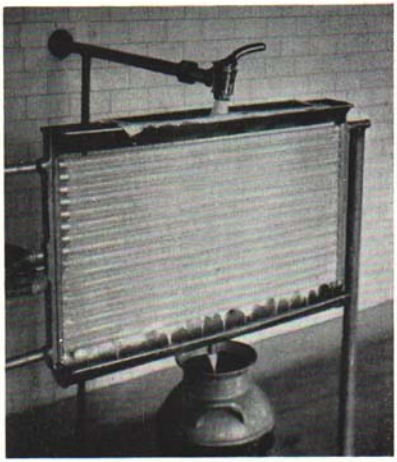

Fig. 8. A tubular cooler with the milk coming from the strainer tank in adjoining room and being rapidly cooled to 40° F.

Cooling tanks are the most common type of milk cooler. Either the concrete tank installed in the milk room or the portable metal tank is satisfactory. The cans of milk are placed in

the tank. Mechanical units for cooling the water are available. If the lids are left on the can and the can agitated sufficiently in the water, the cooling is prompt and effective. While aeration is not possible in this procedure the milk is more completely protected than when the lids are tilted or removed and the milk mixed with a stirring rod.

Tubular coolers are speedy, effective devices for cooling, but they are awkward utensils to wash and sterilize, thus constituting an extra source of contamination. While there is much to recommend them they are seldom used on those farms from which milk is sold wholesale to dairy plants.

Can coolers are devices to cool milk quickly in the can by means of an agitator that stirs the milk and of piping that discharges streams of water to flow down the outside of the can. While some of these are difficult to clean properly they do offer possibilities for effective cooling.

STRAINING THE MILK

The purpose of straining is to remove visible foreign particles that may have found their way into the milk but no amount of straining can transform unwholesome milk into a quality product. Indifference and carelessness during milking, with the possible pollution of the milk, can be partially concealed by straining, but the serious damage to the milk quality cannot be repaired.

The best materials for straining milk are the regular strainer pads, or outing flannel disks, made for this purpose. The pads are discarded after each use. Three or four layers of cheesecloth and absorbent cotton are also satisfactory. A wire-mesh strainer and strainer cloths that are used repeatedly are highly objectionable because they are insanitary. The straining should be done promptly after milking and should be performed away from the cows, preferably in the milk room or a separate straining room.

FEED FLAVOR INJURES MILK QUALITY

While some flavors in milk are due to bacterial or chemical action and can be detected only after the milk has been stored for some time the most frequent off-flavors are due to the feeds—or weeds—the cow consumes. These feed flavors will be observed in freshly drawn milk. They are most noticeable in the spring and summer when cows

are first turned to pasture or onto any luxuriant forage. Certain pastures such as rape, alfalfa and sweet clover cause special difficulty. If cows are taken off the pasture an hour or two before milking the off-flavor will be greatly reduced or eliminated. When pastures become short during dry weather the cows often eat weeds that cause off-flavors. More liberal feeding in the barn will usually prevent this. Proper methods to combat weed growth in the pasture should also be used.

Succulent feeds such as silage should be fed after milking. Similarly, alfalfa hay may cause trouble unless fed after milking. Concentrate feeds do not cause off-flavors in milk.

THE MILK HOUSE FOR A DAIRY FARM

While a milk house is not always considered a necessity in producing quality milk, it is a material aid. The milk house is the logical

Fig. 9. An excellent kind of strainer is being assembled for use. The pad is ready to be inserted. The flow of milk from the pail does not fall directly onto the pad.

Fig. 10. Quality milk must be promptly removed from the stable. Proper straining in the milk house or straining room is the next step before cooling.

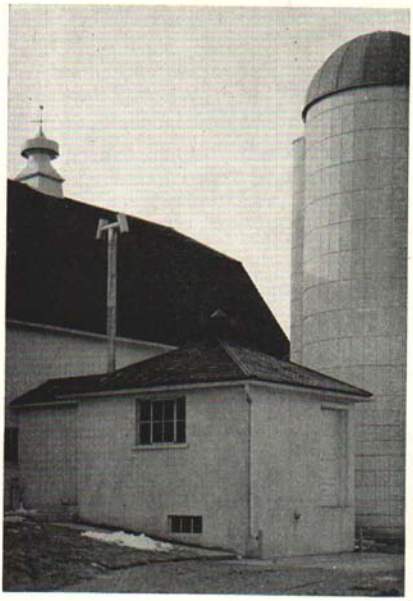

Fig. 11. The milk house on a farm in Ingham County. It is of proper construction and in a clean, convenient location.

location for the cooling equipment and it can effectively accommodate those facilities used in caring for the utensils such as the water heater, vats, storage racks, and supplies. The initial expense of a milk house sometimes appears prohibitive; however, this expense is distributed over a period of several years, and the actual cost per unit of milk is low.

THE PEN-TYPE BARN

The pen-type barn is an arrangement wherein cows are allowed to run loose in a large barn or shed except at milking time when they are admitted to the milking room which has only 2 to 4 stanchions. During milking the cows receive their concentrates.

This type of housing has considerable merit in respect to quality milk production and, while there are some objections, such an arrangement is increasing in popularity and usage. It is worthy of especial consideration by any dairyman who contemplates the remodelling of his present barn or enlargement of his dairy herd.

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