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Production of Clean Milk.

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Clean milk does not mean milk from which all visible dirt is absent or has been extracted but rather raw milk from healthy cows which has been produced under hygienic conditions and which contains only a small number of bacteria and which will remain sweet for a day or so in the hot weather and longer in the cold weather.

A large number of people imagine that to produce clean milk, one must have model buildings and equipment; this is not so, although they are desirable; the chief point is good and reliable milkmen. At the Reading Institute for Research in Dairying, cows have been milked in an old wooden cow byre with a thatched roof, the walls and roof are regularly swept down and the walls whitewashed. The results of the bacteriological examination of the milk produced in this shed are as follows :—

Age of milk in hours.	Temperature when tested.	Number of organisms per 1 c. c.	Presence or absence of bacillus coli.
5	50 F	270	...
5	54 F	510	...
5	54 F	1250	...
6	53 F	820	...
8	55 F	1140	...
8	53 F	400	...
7	60 F	930	...

Granted that it is possible to produce clean milk as above in buildings of this type, it should be less difficult to produce clean milk in modern cowsheds.

The quality of the milk should be as uniform as possible and this is only attained by constant attention to details with good supervision.

The necessary operations should be scrupulously carried out twice a day and this amounts to strict routine.

For an ideal dairy farm in India, it is advisable to erect a milking shed and to keep this specifically milking and feeding. Also enclose a field of two or three acres with wirefence and erect in this a covered shed open at the sides and which ends with a feeding trough down the middle for feeding long fodder in during the day and night; the erection of a water trough is also recommended in this paddock, so that the animals have access to water at all times.

The best floor for the milking shed is cement concrete as this is impervious. On the plains there is only need for end walls, the sides can be left open, double sliding doors at each end are advisable. The mangers should be made of concrete and the ground level. The floor of the standing should slope towards the gutter at the rear of the cow, so that the floor can be easily washed and facilitate easy drainage. Separate standings are advisable since the cows are not so liable to foul the floor by lying on or standing across it. The gutter at the rear of the cows should have a slope and this should run into a liquid manure tank at the outside of the shed away from the milking shed, the top of which is ground level, this should be covered with a movable wooden top. The gutter should be wide and deep, about 18 inches wide, and the depth near the standing about 6 to 8 inches deep and that farthest away from the standing 4 inches; this prevents splashing.

The liquid manure tank should be emptied once or twice a day as occasion arises; dung should be removed immediately if possible or at least twice per day and stored a good distance away from the milking shed, as dung attracts flies. The milking shed should be lime-washed frequently and the floors washed with disinfectant occasionally.

Near the end of the milking shed, a milk receiving room can be erected, a room about 10 feet square is sufficient, the bottom portion of this shed consisting of a brick wall with cement plastering about 3 feet high and the roof supported on pillars, the space in between the pillars being covered with thin wire gauze; this keeps out all flies and the room gets plenty of fresh air and light which is essential. Doors can be made of wire gauze with springs on them to keep them always closed. There should be no crevices in the floor of this shed as these harbour dirt, the walls should be faced with cement and painted so that they can be washed down.

A milk funnel with a strainer inside can be erected outside the milk room and connected with the inside by a pipe. The milk is poured into the funnel from each cow and this runs into the bucket of the herd recorder in the milk-room; the attendant notes the yield and empties this into the milk churn. In this method the milk room is kept closed during the whole process of milking and so there is less chance of dirt or flies getting into the room.

It is most essential that all milk cans, buckets, churns &c. should be properly sterilised after use and put in the sun to dry, this decreases the bacterial content of the milk more than anything else. Souring of milk is often caused through placing milk in cans which have not been properly sterilised. Utensils which are never properly cleaned and sterilised are good breeding grounds for bacteria, as they contain small quantities of milk residues which are constantly being added to. At the Reading Institute *the bacteriological condition of empty milk churns which were supposed to be clean and fit for use revealed:—*

Condition of churns on inspection.	Number of bacteria. per c. c. of washings.	Bacillus coli found in:—
A. Apparently clean and dry ...	6,200,000	1/1,000 c. c.
B. Apparently clean but wet ...	4,100,000	1/100 c. c.
C. Milky water present ...	18,400,000	1/1,000 c. c.
D. Milk present ...	30,300,000	1/100,000

Each churn was rinsed with 1000 c.c.s. of sterile water, a portion of which was used for estimating the number of bacteria. All these churns were assumed to be in a condition fit for use. The latter brings out incidentally the futility of assuming that the mere presence of steam is sufficient to guarantee the necessary cleanliness, since the churns mentioned above came from premises which were in a position to give adequate sterilisation. That this had not been done is evident from the figures which are only one illustration of the conditon into which all the other utensils quickly fall when they are not properly cleansed and sterilised.

The following table shows the results of the examination of other places of apparatus found on farms of good type where the workers were honestly endeavouring to do their best.

Apparatus.	Count per c. c. of washings.	Presence of B. Coli in.	Remarks.
Cooler ...	80,000	1/11,000 c.c.	Appeared clean, washed in hot and cold water.
Cooler ...	11,000	1/100 c.c.	Appeared clean, washed in hot water and cold water and steam sprayed on surface.
Cooler ...	1,464,000	1/1000 c.c.	Greasy, washed in hot and cold water.
Receiver ...	3,870,000	1/100 c.c.	Washed in cold water only.
Receiver ...	53,200	1/100 c.c.	Washed cold and hot water.
Strainer (Metal) ...	96,000	1/10,000 c.c.	Appearence clean.
Milking pail ...	3,000,000	1/10,000 c.c.	Washed in cold water.

Each piece of apparatus was washed with 500 c. c. s. of sterile water, a portion of which was used for making the counts.

These examples suffice to show that any efforts made in cleaning the cows and in improving the methods of milking are stultified by failure to appreciate the necessity for thoroughly cleansing and sterilising the utensils.

All milk utensils must first of all be thoroughly rinsed and scrubbed in cold water inside and outside to remove any milk residue which is left. If this is not done immediately after milking etc. all of them, including the cooler, should be thoroughly rinsed or left to soak in cold water.

On no account should hot water be used for this preliminary rinsing as the albumen in the milk is liable to be coagulated and to stick to the vessel making subsequent washing more difficult.

After the utensils have been washed in cold water, they should be washed in hot water and well scrubbed. If the cans are greasy, a little soda added to the water assists; if the soda is used, a second rinsing in hot water is necessary.

After washing utensils, they can be left to drain for a time and then sterilised by steam. *There is no substitute for steam on the dairy farm.*

Scalding utensils by means of boiling water is satisfactory if steam is not available, but it is not half so efficient as steam.

The following table gives some idea of the keeping qualities of milk when placed in washed vessels, scalded vessels and vessels which are sterilised by steam.

The scalding was done under ideal conditions which could scarcely be equalled in practice, so that the figures given are probably better than would normally be obtained.

Keeping qualities of milk in churns treated in different ways.

Date.	Number of days sweet at 60 F.			
	Control.	Washed.	Scalded	Steamed.
28–11–1922 ...	4	1½	2	4
5–12–1922 ...	3½	1½	2	3½
9–12–1922 ...	3½	1½	2	3½

The control milk remained in the sterile vessel into which it was milked.

It will be noticed that washing is particularly ineffective and in the Indian climate, milk would not keep half this period.

A properly steamed churn should be *dry*. After the churn is removed from the steam jet, it should be laid for a short time on its side to allow the steam to escape and there should be sufficient heat left in the metal to evaporate the small amount of condensation water. If condensation water is noticed in the churn after sterilisation, it should on no account be wiped out with a cloth but placed in the sun to dry.

Milk utensils should be washed and sterilised after each milking in order to get uniformly good milk.

The following table brings this out; the morning milk was taken in utensils which had not been steamed.

Date.	Age in hours.	Temperature tested.	Number of organisms per 1 c. c.
4-1-23 Evening ...	19	48 F	21,000
5-1-23 Morning ...	4	48 F	200,000
0-1-23 Evening ...	20	47 F	31,000
1-1-23 Morning ...	5	48 F	88,000
1-1-23 Evening ...	19	56 F	46,000
1-2-23 Morning ...	4	64 F	72,000

Pails, cloths and brushes which are used in washing the cows should be washed after milking and steamed daily.

Coolies' overalls should be changed once or twice per week and should not be allowed to get into a dirty condition.

Milking.—The first point to notice in this is to see that the cow is clean. The cow should be groomed with a stiff brush and rubbed down with a cloth; all dung should be removed from the body and the udder and the flanks should be washed with luke-warm water and dried with a clean cloth just before milking. The milkman should see that no water is left on the udder which might drop into the milk.

A wash basin, soap and towel should be provided so that the milkman can wash his hands before commencing to milk. Clean milking pail or part of his body cloth may be blown into the milk whilst milking.

Overalls serve the double purpose of preventing contamination of the milker's hands from his clothes and also of fostering that spirit of cleanliness which is so essential in the worker on a clean milk farm.

The first milk drawn from the teat at the commencement of milking should be allowed to run to waste as it has been found that the teat canal has always a little milk remaining in it and this milk becomes contaminated between milkings by bacteria when the cow lies on the ground.

The practice of wetting the hands before milking with either water or milk is to be condemned as drippings from the hand are sure to drop into the milk. The teats if necessary, can be smeared with a little butter in order to facilitate easy milking.

All dung and soiled litter should be removed from the milking shed before milking.

Milk-pails.—The covered type of milking pail is strongly recommended; the opening at the top should be as small as practicable and nearly vertical. An opening 4 inches by 7 inches is the usual size. The object of the covered pail is to prevent contamination from dirt falling into the milk.