A METHOD FOR DETECTING SOURCES OF MILK CONTAMINATION ON FARMS.

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SUMMARY.

A method has been devised for locating readily the sources of milk contamination on dairy farms. The method embodies rinsing with aseptically drawn milk all surfaces likely to provide contamination and performing bacteriological tests on the rinsings. It has been found practicable under Queensland field conditions, and, furthermore, lends itself to considerable modification to suit various conditions.

Results of methylene blue reduction tests and plate counts for several farms are tabulated.

INTRODUCTION.

Experience gained in the control of the bacteriological quality of raw milk supplies has shown that the mere notification of low quality to farmers often does not lead to any real improvement in milk quality. Greater benefit results from instructional visits by dairy advisory officers to farms supplying low quality milk, which are usually successful in effecting improvement in quality. Unfortunately, however, there are many instances where well equipped and apparently well managed dairies produce milk with a low methylene blue reduction time and which shows evidence on microscopical examination of considerable bacterial contamination. In such cases the equipment appears to be superficially clean, and often no fault can be found with the methods of milk production. A method for accurately locating foci of contamination on the farm has been devised which is particularly useful in instances where the cause of low reduction times is not apparent on visual examination.

The method was designed primarily for use in connexion with experimental work concerned with the farm contamination of raw milk supplies, but it is considered that it can be applied by advisory officers as a normal feature of their operations. Briefly, the method consists of the rinsing of all surfaces of utensils and other possible sources of contamination with aseptically drawn milk and the carrying out of methylene blue reduction tests on samples of the rinsings in order to obtain an index of the degree of contamination.

DETAILS OF THE METHOD.

Aseptic Withdrawal of Milk.

The amount of milk required for rinsing purposes depends on the dairy equipment to be examined. For farms not equipped with milking machines, 2,000 ml. are sufficient, but where milking machines are in use an additional 1,000 ml. should be drawn. It is not always possible to obtain the required quantity from one cow; invariably two cows must be milked when milking machines are in use.

The animals selected to provide the rinsing milk should preferably be in early lactation; they should have no udder or teat abnormalities, such as swollen glands, fibrosis, and sores; and the milk from each quarter should be free from clots, slime, blood and bad odour. Prior to drawing the milk the udder, teats and flanks are washed with clean water and the surplus moisture removed with a clean, squeezed-out cloth; the teats, udder and milker's hands are then thoroughly rubbed with cotton wool soaked in a chlorine solution containing 1,000 p.p.m. available chlorine, and excess chlorine solution removed on a squeezed-out cotton wool pad.

After the rejection of the first 8 to 10 streams of milk from each quarter, the milk is drawn into a sterile narrow-necked flask, such as a 2,000 ml. Erlenmeyer flask previously plugged with cotton wool and autoclaved. During milking the cotton wool plug is kept in a sterile jar and replaced immediately after drawing the requisite amount of milk. Strippings are excluded.

Rinsing of Surfaces of Utensils.

When rinsing utensils, care should be taken that the rinsings are made with the surfaces of the utensils in their normal condition. This may be achieved by requiring the dairy operator to make all equipment ready for use by his usual methods prior to performing the rinsing.

In dispensing the aseptically drawn milk a graduated cylinder of 250 ml. capacity is used. This is sterilized before use with a chlorine solution containing 1,000 p.p.m. available chlorine. Rinsing the cylinder with a small portion of the aseptically drawn milk or sterile water removes the greater portion of the residual chlorine. In experimental work both the milk container and the cylinder are covered with sterile petri dish lids to prevent air-borne contamination, but under practical conditions in the field this could probably be accomplished by using clean cups or tumblers as covers, and possibly cotton wool filter pads would suffice.

The following quantities of milk are considered to be suitable for the rinsing of various utensils:—

Milking machine	1,000 ml.
Vat	200 ml.
Can (8 or 10 gallon capacity)	200 ml.
Milking bucket	100 ml.
Strainer	200 ml.
Cooler	200 ml.

In flushing milking machines, a volume of approximately 1,000 ml. of milk is placed in a previously chlorinated bucket, from where it is drawn up through the milking unit most distant from the releaser. The milk used for flushing is collected from the releaser in a sterile container. When rinsing vats,

cans and buckets, it is necessary to tilt and roll each vessel as much as possible so that the milk rinse flows over all surfaces with which milk would normally come in contact.

From each rinsing a 10 ml. sample is retained for testing.

Sampling of Other Sources of Contamination.

Milk may be contaminated on the farm from sources other than dairy utensils. Manure and feed dusts, water, milkers' hands, and various articles of equipment, such as rags and brushes, all present a potential menace to the production of clean milk. These are sampled as follows:—

Manure and Feed Dust:—A 50 ml. sample of aseptically drawn milk is exposed for five minutes in a petri dish placed on the floor. The dish is then closed prior to withdrawing a portion for testing.

Water:—In the examination of water it has been usual to inoculate 1/10 ml. into the 10 ml. of milk required for the methylene blue test, but this quantity may need modification.

Rags and Brushes:—Rags and brushes are used in the dairy for washing or wiping udders and in some instances for wiping utensils. A sample for an estimate of the contamination provided by a rag can be obtained by squeezing out the rag, thoroughly wiping the inside of a previously sterilized and rinsed container—such as a wide-mouthed metal can—and then rinsing the container with 50 ml. of milk. A similar procedure is adopted for brushes, the container being brushed out before rinsing.

Milker's Hands.—These are examined by having the milker rinse his hands in 200 ml. of the aseptically drawn milk, after which a portion of the milk is taken for testing.

RESULTS OF EXAMINATIONS.

For the purpose of demonstrating the utility of the method in ascertaining sources of milk contamination, the results obtained on a number of farms are set out in the appendix. In addition to methylene blue reduction times the plate counts before and after laboratory pasteurization are given for each sample. It will be seen, for instance, that the kerosene tin and Can A sampled on Farm No. 1 carried a bacterial flora which gave the milk a low reduction time. On both Farms Nos. 2 and 3 the milking machine was obviously contaminated, whereas the milking machine on Farm 4 was relatively clean. It is of interest to note, too, how the results reflect the degree of cleanliness of the milker's hands.

DISCUSSION OF METHOD.

The procedure adopted in using the method under experimental conditions can be modified to meet the requirements of field advisory officers. In the experimental work the methylene blue test has been commenced within two hours of sampling, but where it is not practicable to test samples on the day of sampling they can be held until the following day under cool conditions

without nullifying the effects of contamination. Such a modification would enable several farms to be sampled on the one day, and would result in lower reduction times with a consequent saving in the time required for completing the tests (Smythe, 1945). As each farm is treated as a unit, the results obtained from the several farms sampled on the same day will not necessarily be comparable.

The resazurin test could be substituted for the methylene blue test, thus yielding quicker results, but at the present time resazurin is too costly and too difficult to procure in Queensland to permit its substitution for methylene blue.

Where equipment for methylene blue testing is not available to field officers, a simple keeping quality test could be employed. This is a test which could, in fact, be performed by the dairymen himself with the minimum of equipment.

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REFERENCE.

SMYTHE, V. R. 1945. Studies on the effects of storage and transport on the bacteriological quality of raw milk. Part 1. The reduction of methylene blue by raw milk as influenced by the time and temperature of storage. Qld. J. Agric. Sci. 2 (2): 128-56

APPENDIX.

DATA FROM FIVE FARMS.

Surface, &c., Sampled.	Sampling Treatment.	Methylene Blue Reduction Time (hours).	Plate Count per ml.	
			Raw.	After Laboratory Pasteurization 63°C. for 30 mins.
	FARM NO. 1.			
Control milk, drawn aseptically	..	9¼	30	4
Kerosene tin	Milk rinse, 100 ml. ..	4½	32,000	800
Can A	Milk rinse, 200 ml. ..	4¾	33,000	500
Can B	Milk rinse, 200 ml. ..	5¾	5,000	600
Can C	Milk rinse, 200 ml. ..	6¾	..	1,900
Cooler	Milk rinse, 200 ml. ..	7¼	300	25
Udder cloth	Sterile tin wiped with cloth, then rinsed with 50 ml. milk	5¾	4,500	20
Utensil brush	Milk rinse, 50 ml. ..	6¾	12,000	700
Milker A's hands immediately after washing udder	Milk rinse, 200 ml. ..	5¼	9,000	100
Milker A's hands half-way through milking one cow	Milk rinse, 200 ml. ..	5	46,000	130
Milker B's hands immediately after washing mud-coated udder	Milk rinse, 200 ml. ..	5¼	5,000	180
Air on feed platform ..	50 ml. milk exposed for 5 mins.	7¼	400	6
Air under cow being milked	50. ml. milk exposed for 4 mins.	7½	1,500	4
Air in bails	50 ml. milk exposed for 5 mins.	6½	730	20
	FARM NO. 2.			
Control milk A, drawn aseptically	..	9	1,000	0
Control milk B, drawn aseptically	..	9+	1,000	0
Milking machine ..	Milk A rinse, 1,700 ml. ..	3½	216,000	43,000
Can	Milk B rinse, 200 ml. ..	6½	47,000	8,000
Strainer	Milk B rinse, 100 ml. ..	7½	20,000	5,000
Vat	Milk B rinse, 200 ml. ..	9+	5,700	0
Cooler	Milk B rinse, 100 ml. ..	8¼	84,000	6,500
Udder cloth	Sterile tin wiped with cloth, then rinsed with 50 ml. milk B	8½	336,000	5,500
Milker A's hands ..	Milk B rinse, 200 ml. ..	6¼	260,000	1,400
Milker B's hands ..	Milk B rinse, 200 ml. ..	7½	184,000	5,000
Tank water	1/10 ml. in 10 ml. milk B	9+	3,000	..
Air under cow being milked	50 ml. milk B exposed for 5 mins.	9+	1,000	5
Air in bails	50 ml. milk B exposed for 5 mins.	9+	1,700	0
Feed dust	50 ml. milk B exposed for 5 mins.	9+	1,200	5

DATA FROM FIVE FARMS—*continued.*

Surface, &c., Sampled.	Sampling Treatment.	Methylene Blue Reduction Time (hours).	Plate Count per ml.	
			Raw.	After Laboratory Pasteurization 63°C. for 30 mins.
FARM NO. 3.				
Control milk A, drawn aseptically	..	9+	350	5
Control milk B, drawn aseptically	..	8¾	550	5
Milking machine ..	Milk A rinse, 1,700 ml. ..	2¼	2,000,000	58,000
Can	Milk B rinse, 200 ml. ..	7¼	53,000	20,000
Strainer	Milk B rinse, 100 ml. ..	9	1,500	150
Vat	Milk B rinse, 200 ml. ..	8	8,800	50
Cooler	Milk B rinse, 100 ml. ..	8¾	3,000	20
Udder cloth	Sterile tin wiped with cloth, then rinsed with 50 ml. milk B	7¾	900	25
Vat rag	Sterile tin wiped with cloth, then rinsed with 50 ml. milk B	8½	900	35
Milker's hands	Milk B rinse, 200 ml. ..	5½	25,000	750
Tank water	1/10 ml. in 10 ml. milk B	9	1,400	..
Air under cow being milked	50 ml. milk B exposed for 5 mins.	8½	580	10
Air in bails	50 ml. milk B exposed for 5 mins.	9	750	5
FARM NO. 4.				
Control milk A, drawn aseptically	..	..	55	..
Control milk B, drawn aseptically	..	9½+	100	5
Milking machine ..	Milk A rinse, 1,500 ml. ..	8	3,200	2,000
Can A	Milk B rinse, 200 ml. ..	6½	28,000	24,000
Can B	Milk B rinse, 200 ml. ..	5¼	200,000	21,000
Udder cloth A	Sterile tin wiped with cloth, then rinsed with 50 ml. milk B	9½	300	0
Udder cloth B	Sterile tin wiped with cloth, then rinsed with 50 ml. milk B	9½+	370	10
Milker A's hands ..	Milk B rinse, 200 ml. ..	5½	32,000	3,400
Milker B's hands ..	Milk B rinse, 200 ml. ..	5¼	37,000	..
Tank water	1/10 ml. in 10 ml. milk B	9	1,400	..
Air under cow being milked	50 ml. milk B exposed for 5 mins.	8½	4,500	500
Air in bails	50 ml. milk B exposed for 5 mins.	9	140	0
Bulk milk entering can	..	6½	45,000	7,000

DATA FROM FIVE FARMS—*continued.*

Surface, &c., Sampled.	Sampling Treatment.	Methylene Blue Reduction Time (hours.)	Plate Count per ml.	
			Raw.	After Laboratory Pasteurization 63°C. for 30 mins.
	FARM No. 5.			
Control milk drawn aseptically	..	9+	45	0
Can A	Milk rinse, 200 ml. ..	7½	84,000	33,000
Can B	Milk rinse, 200 ml. ..	6½	81,000	20,000
Bucket	Milk rinse, 100 ml. ..	6½	11,400	100
Vat and cooler	Milk rinse, 200 ml. ..	9+	400	20
Udder cloth	Sterile tin wiped with cloth, then rinsed with 50 ml. milk	5¼	7,000	150
Milker's hands immediately prior to beginning milking	Milk rinse, 200 ml. ..	5	52,000	150
Tank water	1/10 ml. in 10 ml. milk	9+	10,000	..
Air under cow being milked	50 ml. milk exposed for 5 mins.	8	250	20
Air in bails	50 ml. milk exposed for 5 mins.	7	9,000	10