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Dairying

THE WEST OF SCOTLAND AGRICULTURAL COLLEGE

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FARM LABOUR STUDIES No. 8

**A STUDY OF BYRE MILKING
IN SOUTH-WEST SCOTLAND**

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A STUDY OF BYRE MILKING IN SOUTH WEST SCOTLAND

by R. Turner and R. D. Murray

SUMMARY

A study of the milking operations on 9 farms has shown a wide variation in the average time taken to milk a cow.

The most important factors affecting milking performance are discussed. Badly adjusted equipment may impair the efficiency of the milking machines and may make the frequent use of back cords necessary. On some farms the time taken for machine stripping could be reduced without detriment to the milk quality or yield. Conveying milk from byre to dairy in churns - on a churn barrow - took about half the time required to carry it in pails. A suggestion is made that over-milking may be common and is sometimes due to the use of too many machine units. The need to adjust the number of machine units to the yield of the herd is therefore stressed.

Finally it is suggested that it may be to the dairy farmer's advantage to pay more attention to the details of his milking methods.

INTRODUCTION

Milking has been carried out by machine, in the West of Scotland, for 30 to 40 years, but in spite of this, gaps still exist in the precise knowledge of the times taken for milking and the methods and organisation in use on different farms. In order to throw more light on these matters the work of milking was studied on a number of farms and the existing practices were observed, so that the factors affecting milking performance could be examined. Nine farms were visited, three each in the counties of Ayr, Lanark and Renfrew. The selection was restricted to farms with herds in which about 30 to 40 cows were milking, where the cows were housed in byres and were milked by bucket units in the traditional manner. All the cows were Ayrshires except on Farm A where the breed was Friesian.

The studies were made during the winter period of 1962-63 when the cows were housed indoors. Plans of the layout of each farm were prepared and production studies were made of an evening milking. This entailed timing the operations during milking and the washing up of dairy dishes. In addition, particulars of the equipment used, cow yields and other relevant details were ascertained.

ORGANISATION OF MILKING

Basic Information

The basic information obtained from each farm is shown in Table I.

Table I

BASIC DATA

Farm No.	No. of cows in herd	No. of cows milked	No. of workers	No. of units in use	Duration of Milking hrs. min.	Overall Man Time min.	Overall Man Time per Cow milked. min.
A	42	34	2	5	1.27	141	4.15
B	34	26	2	3	0.55	94	3.59
C	45	35	2	4	1.31	179	5.11
D	49	38	2	4	1.59	206	5.43
E	32	25	1	4	1.2	62	2.47
F	56	37	2 + 1 part time	5	1.8	125	3.39
G	74	47	2	5	1.21	135	2.88
H	57	39	1 + 3 "	5	1.6	94	2.40
J	60	60	2 + 2 "	6	1.44	248	4.13

The farms were all family farms where the work was done by the farmer or members of his family. Only in Farm J was one of the workers a hired byreman. On Farms A, B, C, F and H, almost all the work of putting on and changing units was carried out by one worker, the other being engaged in washing udders, carrying milk and attending to work in the dairy. On Farms D and G the work was shared by two workers. On Farm F a third worker helped to forestrip some of the cows for a short period, while on Farm H two workers helped in putting on units for ten minutes at the start of milking and a fourth helped to wash up the equipment at the end of milking. On Farm J two workers changed units throughout milking and were assisted by a third for three quarters of an hour towards the end, while a fourth came in to wash up equipment.

The term Duration of Milking, as used in Table I, represents the time taken for the whole job of milking and washing up equipment. It runs from the time when a start was made filling washing buckets or preparing equipment, until the equipment was washed up after milking. This time is irrespective of the number of persons engaged in milking.

The Overall Man Time is the sum of the time spent by all the workers and represents the total time in man minutes taken for milking by all the persons engaged. The figure does not include any time spent in work not directly concerned with the job of milking, such as feeding calves.

From these figures it is not possible to make a true comparison of the time taken for milking on the various farms, but, if the overall man time is expressed per cow milked, the performance on the farms is then comparable - as shown in the last column of Table I. The figures range from 2.47 min. per cow on Farm E to 5.43 min. per cow on Farm D. This wide variation clearly shows the need for investigation in order to try to explain the reasons for the differences.

Analysis of Overall Man Time

The Overall Man Time includes time spent on milking, on washing up dairy dishes at the end of milking and, on some farms, time spent on feeding cows during milking. The breakdown into these items is shown in Table II.

Table II

ANALYSIS OF OVERALL MAN TIME

Time taken - man minutes

Farm No.	Overall	Feeding cows	Washing Dairy Dishes	Milking only	No. of Cows Milked per Man Hour.
A	141	-	22	119	17
B	94	-	14	80	20
C	179	20	12	147	14
D	206	7	24	175	13
E	62	-	4	58	26
F	125	6	7	112	19
G	135	-	23	112	25
H	94	1	16	77	29.5
J	248	-	12	236	15

In order to focus attention on milking proper, feeding and washing up are discussed first.

Feeding Only on three of the farms was feeding done during milking. On Farm C a cooler with spring balance attached was used and the ration

for every cow was weighed. About half of the time was spent filling the bucket and weighing the ration and about half feeding and moving down the byre. On Farm D a cooler was used and the troughs were filled by a pail. The rations for each cow were not accurately measured and sometimes a pailful was shared between two neighbouring cows. The troughs on Farm F were filled from individual pails hanging at each stall, one for each cow, which contained the correct ration which had been weighed out previously.

Washing Dishes This work included the dismantling and washing of units and other equipment and in some cases the washing and swilling of the dairy and scullery floor. There was some variation in the attention which was paid to this work. On some farms the equipment was all dismantled and meticulously scrubbed, on others, since it was the evening milking, equipment was merely rinsed, so that less time was taken. As a consequence the total time taken varied widely. All farms had surface coolers, except Farm E, where in-churn cooling was used, and Farm H which had a bulk milk tank. At Farm E the evening dairy work consisted of washing the units only.

Milking Milking proper was taken as starting with the preparation of washing water or taking the units into the byre, whichever was the first and it finished when the last unit was returned to the dairy. The figures in the fifth column of Table II show the total time taken for milking proper on each farm. Again some measure is needed to compare the performance on different farms. A measure commonly used for this is the number of cows milked per man hour. The figures for these are shown in the last column of Table II. The numbers vary from 13 to 29.5 cows per man hour.

It is generally considered that, in good practice, the throughput in a byre should be between 20 and 30 cows per man hour, but the exact figure depends on the circumstances at the farm. It will be seen that at least three of the farms have reached this figure. In order to understand how such throughputs are attained, the factors which influence milking performance must be discussed.

FACTORS AFFECTING MILKING PERFORMANCE

It is desirable that cows should be milked as rapidly as possible but it is equally important that, in achieving this, neither the quantity nor the quality of the milk should suffer and that the health and wellbeing of the cows should be fully maintained. These points are borne in mind in the discussion which follows.

The milking performance in a byre is governed by a number of factors

and, for convenience, these can be divided up as follows:

1. The Effectiveness of the Milking Equipment,
2. The Work Routines used,
3. The Average Yield of the Cows,
4. The Layout of Buildings.

1. The Effectiveness of the Milking Equipment

For milking to be carried out efficiently, the equipment used must be suited to the size of the herd and the conditions under which it is kept, and it must be maintained in good working order.

Details of the milking machines used on each farm are shown in Table III.

Table III

MACHINE MILKING

Farm No.	Make of machine	<u>Vacuum Gauge Reading</u>		Observed Pulsation Rate (pulses per min.)
		Farm Gauge (ins. of mercury)	Test Gauge (ins. of mercury)	
A	Gascoigne Electronic	11½"	12½"	60
B	Alfa Laval	12¾"	13¼"	46
C	Alfa Laval	16 "	14 "	60 to 80
D	Alfa Laval	12½"	13½"	70 to 90
E	Gascoigne	15 "	14½"	64 to 88
F	Manus/Fullwood	out of order	10½ - 12"	50 to 70
G	Alfa Laval Electronic	12¾"	12 "	50
H	Alfa Laval	14 "	14½"	54 to 82
J	Manus/Fullwood	15 "	15 "	42 to 75

Vacuum The vacuum pump should be capable of producing the necessary vacuum at all points in the system. It may happen that, if a herd is increased and additional machine units or a milk lift added, the pump is no longer capable of maintaining sufficient vacuum and trouble may be experienced from teat-cups falling off.

The normal vacuum at which milking machines work is from 13 to 15 inches of mercury. A test of the vacuum level at each farm was made by means of a gauge with a piece of rubber tubing attached so that it could be operated at any of the byre stopcocks. It will be seen that

the readings at the gauges installed in the byres differed slightly from those of the test gauge. The difference is small and may not be significant except perhaps in the case of Farm C. The vacuum reading was more or less within the correct range for all farms except A and G, where it was too low, and F where it was both low and fluctuating.

Pulsation Rates For modern milking machines the rate of pulsation recommended by the makers is as follows:-

Alfa Laval vacuum type	38 to 40	pulses per minute		
Alfa Laval pneumatic	55	"	"	"
Gascoigne vacuum type	48 to 50	"	"	"
Manus Fullwood " "	46	"	"	"
Electronic Machines	50 to 60	"	"	"

Some of the older machines of these makes may have had different pulsation rates. It would seem, however, that most of the units observed were operating at too high a rate. There was also a considerable variation in the pulsation rates of different units on the same farm. Thus on one farm a single cow might be subjected to a total of 666 impulses at one milking but, if milked with a different unit at the next milking only 500 impulses, or, to take another example, 321 impulses at one milking and 574 the next. While the precise effect of such differences on the cows may not be fully understood, it seems logical that they should be subjected to the same pulsation rates at each milking. There is no great difficulty in adjusting pulsators, so it would be desirable to make the rate the same for all units on a farm.

It is clear that more frequent checks and adjustments of the milking equipment on farms would help to ensure that it was kept in good working order.

2. Work Routines

In carrying out milking, there is a series of operations which must be carried through for every cow milked, - washing udders, putting units on, taking units off and so on - and in addition, there are a number of operations which must be carried out at less frequent intervals - pouring milk from units into a pail, carrying milk, attending to milk churns and so on. All these taken together form the work routine, and this can be expressed as the average time taken per cow. Table IV shows the work routine times on the farms studied.

Table IV

WORK ROUTINE TIME

Farm No.	Man min. per cow	Farm No.	Man min. per cow
A	3.33	F	2.53
B	2.55	G	2.30
C	3.49	H	1.98
D	3.97	J	3.53
E	2.07		

The minimum time, in man minutes, required to milk a herd is the sum of the routine time of all the cows milked. Thus the shorter the routine time, the shorter will be the time required for milking the herd. It is considered that a good routine time would be from 2 to 2.3 minutes per cow. On three of the farms, the work routine time was 2.3 min. or less and these were also the farms on which the highest number of cows were milked per man-hour. The work routine time is governed by the methods used and the time taken to carry out each of the small operations, so in order to suggest where time might be saved in the work routines, some of the individual operations must be examined.

Washing Udders In washing udders, the time spent and the method used are of less importance than ensuring the absolute cleanliness of the udder. Generally, the cows were washed in batches of 3 or 4, or more. The average time spent per cow for this operation varied from 0.25 to 0.6 minutes. On two farms the cows were foremilked into a strip cup, on another, half the cows were foremilked on to the standing, while on the remaining farms an occasional cow was foremilked usually on to the standing. Proper preparation of the udder is regarded as important in assisting cows to let down their milk quickly and milk out completely. In order to ensure that the stimulus of washing is not lost, cows must not be washed too far in advance of applying the teat cups to the udder. In fact a strong case can be made for washing a cows udder and putting on the unit before proceeding to the next cow.

Machine Stripping By this is meant the practice of putting pressure on the claw piece and massaging the udder to withdraw the final strippings of milk. It is considered necessary to define the operation, because it appears that some farmers do not recognise it as stripping. The average time per cow taken for this, on the various farms, is shown in Table V.

Table V

MACHINE STRIPPING TIME

Farm No.	Min. per cow milked	Farm No.	Min. per cow milked
A	.54	F	.60
B	.29	G	.77
C	1.28	H	.24
D	1.60	J	1.50
E	.31		

In practice, the time taken for stripping individual cows varied from nil to 3.52 minutes. The reason given for stripping cows is that the strippings have a high percentage of butter fat and it is considered that leaving them in the udder tends to lower the quality of the milk and reduce subsequent production. In some herds, it takes longer to strip the cows than in others, because they have become accustomed to long stripping times and they will not let down their milk without them. Such cows can usually be trained to do with less stripping, starting from the beginning of a new lactation.

The modern view of stripping is that, for any herd, the average time taken per cow should not be more than about $\frac{1}{4}$ or $\frac{1}{3}$ of a minute. In fact, there is a body of opinion which considers that machine stripping could be eliminated altogether.

Carrying Milk Two methods were used for carrying milk to the dairy. On five farms the milk was carried in pails and poured into the D. tank of the cooler by hand. On the remaining four farms it was poured into churns in the byre and the churns were taken by barrow to the dairy where the milk was raised to the cooler or bulk tank by a milk lift. On farms where the milk was carried in pails the average time taken to carry 10 gallons was 2.6 minutes but where the milk was carried in churns the average time taken was only 1.3 minutes per 10 gallons. There would therefore seem to be some advantage in barrowing milk to the dairy in 10 gallon churns, since not only does it take less time, but the work is less fatiguing.

Use of Back Cords On some of the farms, units were tied on to the backs of some of the cows with cords, to prevent them falling off the udders during milking and an appreciable amount of time was spent collecting cords and changing them from one cow to another. Generally

speaking, this operation should not be necessary if sufficient vacuum is available and the most suitable type of teat cup liner used. Where back cords are found to be necessary skilled advice on the equipment is required.

Other Operations The times taken to carry out each of the other operations, such as putting units on or off a cow, varies a little according to circumstances and the skill and dexterity of the worker, but they showed less variation from farm to farm than the operations mentioned above.

Organisation of Work When two persons are engaged in milking, probably the most effective results are obtained when both share the washing and milking of the cows. Where one person milks and the other washes udders and carries milk, the milker usually has the hardest work to do while the other worker may not be fully employed. This does not always show up because the second worker may appear to be busy, yet, if necessary, he could accomplish more work without undue fatigue.

3. Yield of Cows

The efficiency of milking is affected by the yield of the cows and their ability to let down their milk, because this governs the time the units are required to remain on the udder. For each herd, the average evening yield per cow at the time of the observations is shown in Table VI together with the time the units remained on the cows' udders.

Table VI

EFFICIENCY OF PRODUCTION AT AN EVENING MILKING

Farm No.	Av Yield per cow lb.	Av Unit-On Time per cow min.	Av Rate of production lb./min.	Calculated Unit-On Time per Cow min.	Difference between actual and calculated Unit-On Times per Cow min.
A	14.5	6.5	2.6	4.7	+ 1.8
B	11.5	3.8	3.0	4.2	- 0.4
C	11.5	8.3	1.4	4.2	+ 4.1
D	14.2	8.2	1.8	4.7	+ 3.5
E	15.9	7.2	2.1	4.9	+ 2.3
F	14.1	6.9	2.2	4.6	+ 2.3
G	12.7	4.8	2.8	4.4	+ 0.4
H	11.7	6.3	2.0	4.3	+ 2.0
J	10.5	7.7	1.4	4.1	+ 3.6

The milk yields of the individual cows were obtained from the milk recording made nearest to the date of the observation, except on Farm D, where no regular recording was done and the farmer's estimate, checked with the total evening production, was accepted; and Farm J, where the average yield only was obtainable, based on the evening production on the day of the study. Although these yields were not the exact yield on the day the work was observed they are near enough for general conclusions to be made.

Unit-On Times The length of time the units remained on each individual cow in a herd varied from 2 minutes for a cow yielding 5 lb. of milk to almost 14 minutes for a cow yielding 25 lb. The average "unit-on" times for the cows in each herd varied less widely and these are shown in the 3rd column of Table VI. The 4th column shows the average rate at which milk was produced on each farm. This figure may be taken as one of the possible measures of the efficiency of milk production, depending as it does, on the yield of the cows and the time taken to milk them.

A distinction must be drawn, however, between the time the units remain on the cows and the time required by the cows to release their milk. It is not easy to organise milking so exactly that the worker returns to each cow to take off the unit just at the moment when the cow's milk flow has ceased, so it is inevitable that units are on cows' udders for some time after they have finished yielding milk.

Overmilking Overmilking is to be avoided because it is likely to be harmful to the cows. When the unit is operating and no milk is flowing the teat cups tend to ride up and damage the teats setting up an inflammation which may lead to mastitis. Cows tend to let down their milk better if they are milked quickly and without delay.

It is of interest to know the extent to which overmilking occurs and it is possible to obtain a rough measure of this on the herds studied. Work at the National Institute for Research in Dairying and elsewhere has shown that the average time per cow required by a herd to let down its milk varies almost directly with the average yield of milk. A formula has therefore been devised by which, for a normal herd, a reasonably accurate prediction of the milking time can be obtained from the milk yield of the herd. (M.A.F.F. Bull. 177.) This formula applies only to the average milking time of the herd. Individual cows may vary in their rate of let down and there are a few which, because of the small size of their teat orifices, are slow milkers; nevertheless, most cows are near the average.

Using this formula, the calculated theoretical unit-on time per cow can be ascertained for each herd and this is shown on the 5th column of Table VI. The difference between the actual and calculated

unit-on time is given in the last column. In two of the herds, the difference was negligible, which suggests that there was no overmilking. In the remaining herds the difference lay from about 2 minutes up to 4 minutes, which suggests that there may have been some overmilking in these herds.

Overmilking is often caused by using too many units. As mentioned earlier the worker has to spend a certain time at each cow carrying out the essential routine operations. If, for example, he is operating 4 units, he will have to complete the routine on four cows before he can return to remove the unit from the first cow. It may well be that the first cow had finished milking by the time the third unit had been changed, and was therefore overmilked by the amount of the time taken to carry out the routine on the fourth cow. Assuming a work routine time of between 2 and $2\frac{1}{2}$ minutes, if the average amount of overmilking per cow exceeds this, then a unit less could be used. It should, however, be noted that if too few units are in use, the milking time of the cows will be longer than the routine time of the worker, so that he will have idle time, waiting for the cows to finish milking, and milking will take longer to complete by that amount.

There are several reasons why too many units are used. Generally, the number of units is governed by the number required at the morning milking during the peak yielding period of the herd. As milk yields fall, however, there may come a point at which the average milking time per cow has been so reduced that one unit less could be used. In the same way it may happen that the difference in yields between the morning and evening milking is such that a unit less could be used in the evening. There is need, therefore, to vary the number of units as the average yield of the herd rises or falls.

An improvement in the working methods which reduced the routine time might not only enable the units to be handled more effectively, but might also make it possible to increase the number of units handled by one man. For example, the installation of round the byre milking, or a bulk milk tank, or some of the improvements in routine suggested earlier, might so reduce the routine time that an additional unit could be handled within the cows' milking time.

4. Buildings

While convenient layout of buildings facilitates work at the steading it was difficult to find any measure by which the buildings on the farms studied could be compared. Most of the byres were fairly old and in some cases rather narrower than was convenient for working. The position of the dairies and sculleries, on the whole, was convenient to the byres but on some farms the milking machine motor was housed some distance away and a comparatively long walk had to be taken

to switch it on and off.

On most of the farms observed, the milking was done in artificial light. All farms had electric light but, on several, it was rather poor. This was due to the lamps used being of too low wattage and because the lamps themselves had not been kept clean. Poor lighting is liable to cause eye strain to the workers. When producing such a commodity as milk, where cleanliness is so important, it would seem to be desirable that the lighting should be very good. Improvement could easily be effected by putting in more powerful lamps and cleaning them periodically. The extra electricity used would be very small and the cost negligible, but the improvement in comfort and convenience would be great.

CONCLUSION

The need to reduce the cost of milk production was never more pressing than it is today. To do this, farmers have to maintain efficiency in all aspects of production. The report indicates that something can still be done to improve milking methods in the traditional byre. Although the time saved by some of the suggested improvements is small, added together, they may result in an appreciable saving of time, which can sometimes be put to profitable use in other work. Even if the time saved is not significant, the saving of human energy and the consequent reduction of fatigue is important in making the work more pleasant for the worker. In addition, more efficient milking practices may lead to slight increases in yield and may also result in an improvement in the wellbeing of the cows. Despite the advances in animal husbandry and in milking equipment which have been made over the past years, it may be to the advantage of the dairy farmer today to pay more attention to the details of his milking methods.

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