SURVEYS OF FARM MILKING SHED PERFORMANCE

H. J. CLIFFORD
New Zealand Dairy Board, Wellington

SUMMARY

Advantages and disadvantages of surveys of farm milking shed performance are listed and results from a number of such surveys are discussed.

These illustrate changes which have occurred in type of milking shed used, the number of cows milked per man, the number of sets of cups used per man, and number of cows milked per man-hour.

The limitations of using calculated "bail time" as a guide to the average time cows are exposed to milking machine action are noted.

Relationships between "sets of cups" per man, "cups-on-time" and cows milked per man-hour are discussed, and it is suggested that the less efficient use of labour in multi-man sheds is due mainly to fewer sets of cups being used per man than in one-man sheds.

Factors contributing to the smaller number of cows milked per man-hour in doubled-up herringbone sheds as compared with single-unit ones appear to be increased work associated with more batch changes and the hanging up of cups between cows.

A SUBSTANTIAL PROPORTION of New Zealand's export income is derived from milk products and one of the most important facets of milk production is the extraction of milk from the cow. The average farmer probably spends about three hours a day milking and about another hour preparing for milking and cleaning up afterwards. Yet knowledge of how to extract milk from the cow in the most efficient manner is far from complete. More needs to be known about the physiology of the cow and the best use of labour and equipment.

In this paper the advantages and disadvantages of field surveys of farm milking shed performance will be discussed and then some results will be presented for illustration.

ADVANTAGES

Field surveys of farm milking shed performance are an inexpensive way of obtaining information useful to research and extension:

(1) Field surveys are inexpensive as the buildings, equipment, animals and men are already in existence on farms

and do not have to be specially set up on a research station. The only cost involved is in making the observations and processing the data. A wide range of situations is available for simultaneous investigation.

(2) Milking shed designs have usually been evolved by farmers rather than introduced as a result of research findings. Any experimental work on building design should thus be preceded by a field survey to discover what types of installation are already in use.

The minds of about twenty thousand dairy farmers and their employees are a great potential source of new ideas. These people suffer twice daily from the inefficiencies of their existing milking facilities and routines and are therefore constantly encouraged to think of improvements.

(3) Field surveys provide information for research. They may show what aspects of the milking process need to be investigated and they provide a standard of what is being achieved by the people who milk cows every day for a living. This should help to avoid making recommendations which are unacceptable to the farmer. Any suggestion that he should make a change which might increase his working day will be ignored unless there is convincing proof it will bring in sufficient extra income to make the effort worth while.

To carry out work study on milking routine in a research installation without knowledge of current farm practice might exclude consideration of short-cuts which were already in use. In herringbone sheds, examples are the stimulation of two udders at once by using both hands, and opening the front gate before the last cows in the batch have finished milking to reduce batch changing time.

(4) Field surveys assist extension workers to help farmers. If a survey is carried out by extension workers, the sense of involvement enhances their interest in the results and makes them more aware of what might be going on in the milking sheds of farms they visit in the course of normal advisory work. Despite the importance to farm production of efficient milking, it is not a job often observed by extension workers because strangers in the shed are a nuisance at milking time.

Information from field surveys can bring to the attention of extension workers aspects on which advisory work should be concentrated.

Survey results can sometimes carry more weight with a farmer than research results because he can more easily

relate his own achievements to those of other farmers than to those of a research team.

Information on present levels of achievement can be helpful in planning new milking facilities.

(5) Field surveys, if carried out at intervals, provide a measure of changes in farm practice and may be used to confirm research results, or, by finding to what extent they have been adopted, to see how effective extension has been.

DISADVANTAGES

(1) A large number of factors affect milking performance and the number of combinations met with in the field can make it difficult to analyse results.

(2) To obtain a large number of observations in a variety of conditions at a similar point in lactation requires a number of observers and introduces the possibility of differences between them affecting results.

(3) It may not be possible to make precise measurements, as, even if observers were trained to use specialized equipment, it is unlikely to be available to a large number of them working simultaneously in all parts of the country.

(4) Even if observations are made in a large number of milking sheds on milking performance in relation to design, there is a possibility the results may still be biased. It has been suggested that some makes of car are more accident-prone than others, not because of mechanical defects but because they attract accident-prone drivers. Perhaps it could be argued in the same way that a particular design of milking shed attracts a particular type of milker!

(5) If the survey is carried out by means of a postal questionnaire, the information sought must be limited to what the farmer can answer readily from knowledge he already possesses.

SOME RESULTS OF FIELD SURVEYS

1948-9 Survey

In the 1948-49 season, the New Zealand Dairy Board carried out a survey of 610 milking sheds of which 121 were investigated in detail (Anon., 1949).

All sheds were of the "walkthrough" type where cows stand parallel in individual bails, pairs of bails being

separated by a "dummy" on which there are one or two sets of cups.

If there is one set of cups between each pair of cows, the shed is described as "single unit", if there are two sets it is described as "doubled-up".

The following items of information are among those obtained from the survey.

(1) There was more efficient use of labour in doubled-up sheds (26 cows milked per man-hour) than in single-unit sheds (22 cows milked per man-hour).

The average number of sets of cups per milker was 2.4 in single-unit sheds and 4.2 in doubled-up sheds.

(2) Increased numbers of cows milked per man-hour were associated with increased numbers of sets of cups per man.

In single-unit sheds, for example, milkers with 4 sets of cups milked 58% more cows per man-hour (30.4) than milkers with 2 sets of cups (19.2).

(3) The number of cows milked per set of cups per hour was 48% higher in single-unit sheds (9.3) than in doubled-up sheds (6.3).

This was because in single-unit sheds, cups could be swung straight from one cow to the next instead of waiting until a milked cow was replaced by an unmilked one which then had to be prepared for milking.

(4) The more sets of cups used per milker, the longer they were left on the cows. At 1 to 1.5 sets of cups per milker, they were on cows 5.6 min while at 4.6 to 6 sets of cups per milker they were on for 8.2 min.

(5) There was no difference in the number of cows milked per man-hour between herds of different production levels. There was thus no reason to think that a high output of cows per man-hour was necessarily detrimental to production.

1962-3 Survey

In 1962-3, the New Zealand Dairy Board carried out a survey of 713 sheds of which 129 were investigated in detail (Anon., 1963).

At this time stoopless milking had been introduced in two forms, the tandem which never became very popular and the herringbone which was already superseding it.

In the general survey of 584 sheds, 11 were tandem, 74 were herringbone and the remainder were walkthrough.

The 129 sheds investigated in more detail were all herringbones of the high-line single type.

(1) The general survey again showed that more cows were milked per man-hour in doubled-up walkthrough sheds than in single-unit ones.

(2) It was also evident that two-milker walkthrough sheds were making less efficient use of labour than one-milker sheds.

For doubled-up walkthrough sheds in the 60 to 79 cow herd size group, the average for 50 one-man sheds was 43 cows per man-hour, while for 55 two-man sheds it was 25 cows per man-hour.

(3) When sheds were grouped according to the number of milkers working in them and according to the size of the herd, it was seen that as size of herd increased so did the number of cows milked per man-hour.

It appeared that, when faced with more cows per man, milkers either installed more sets of cups or took other steps to increase their output. Perhaps improvements in efficiency are made more in response to necessity than for their own sake.

(4) A comparison of herringbone and walkthrough sheds showed that herd size was 20% larger where herringbone sheds were used (103 cows) than in walkthrough sheds (86 cows).

Butterfat production per cow was 3% lower in herringbone sheds (herringbone 286 lb, walkthrough 294 lb) but, because the number of cows per man was 23% greater (herringbone 64, walkthrough 52), butterfat production per milker was 20% higher (herringbone 18,248 lb, walkthrough 15,234 lb). When only one-man sheds were considered, butterfat production per man was 32% higher in herringbone than in walkthrough sheds.

Another way of comparing herringbone and walkthrough sheds is to follow results on farms which have changed to herringbones. In this survey, the change to herringbone milking was associated with a marked increase in herd size so that the average number of cows per milker was increased from 49 to 56. In fact, for 83 farms for which information was available, the total milking manpower was reduced by 5 men while cow numbers were increased by 600.

(5) There was frequently a drop in production per cow associated with the change to herringbone milking. This

effect had also been noted by Scott (1962) and attention focused on it stimulated farmers and extension workers to try to do something about it.

(6) A comparison of one-man and two-man herringbone sheds (Table 1) showed trends similar to those seen in walkthrough sheds.

TABLE 1: PERFORMANCE IN ONE-MAN AND TWO-MAN HIGH-LINE SINGLE HERRINGBONE SHEDS (1962)

	One-man sheds (n = 49)	*Two-man sheds (n = 65)*
Average no. cows/man	73	53
Average no. sets cups/man	6.6	4.4
Average no. cows/set of cups	11.1	12.2
Average no. cows/man-hour	56	38
Average no. cows/set cups/hr	8.5	8.6
Average washing and stimulation time (sec)	20	24
Average cups-on time (min)	6½	6½
Average milking time/herd (min)	78	85

More cows per man (38%) were milked in one-man than in two-man sheds. More sets of cups per man were used in one-man sheds, a 48% higher output of cows per man-hour was achieved and total milking time was shorter.

The length of time cups were on the cows was the same in both cases but a slightly shorter time was spent on washing and stimulation in one-man sheds.

This 1962 survey illustrated the increased productivity of labour in herringbone compared with walkthrough sheds. It confirmed that more cows were milked per man-hour when extra sets of cups were available, and this may have been part of the reason why multi-man sheds made less efficient use of labour than one-man sheds.

1967-8 SURVEY

By 1967, the principle of herringbone milking was being increasingly accepted and probably about 30% of all New Zealand milking sheds were of this type.

Because a new development in herringbone milking was becoming more popular — the doubled-up shed — the Dairy Board (Jackson and Murray, 1968) made a compari-

son between the ordinary herringbone (high-line single) and the two types of doubled-up herringbone (high-line doubled-up and low-line doubled-up).

The least common of the three types was the high-line doubled-up, and so it was decided to find as many of these as conveniently possible and to match each one with a low-line doubled-up and a low-line single, each with the same number of milkers and similar herd size. One hundred and thirty-four sheds were in this survey.

For all three types of shed, the familiar trend was apparent — decreasing output of cows milked per man-hour as the number of milkers in the shed increased.

The most common number of milkers was two, and a comparison of various items for the three types of shed with this number of milkers is shown in Table 2.

TABLE 2: PERFORMANCE IN TWO-MAN HERRINGBONE SHEDS OF THREE DIFFERENT TYPES (1967)

	High-line Single (n = 33)	*High-line Doubled-up (n = 28)*	*Low-line Doubled-up (n = 30)*
Average no. cows/man	68	67	68
Average no. sets cups/man	6.1	7.2	7.4
Average no. cows/set cups	11.4	9.3	9.2
Average no. cows/man hour	51	42	46
Average no. cows/set cups/hr	8.5	5.9	6.3
Average washing and stimulation time (sec)	18	20	15
Average cups-on time (min)	7	6	5¼
Average milk yield/cow, at survey milking (lb)	12.6	12.1	12.4
Average milking time/herd (min)	81	95	88

The number of cows per man was similar in all three groups but the number of sets of cups per man was higher in the doubled-up sheds. This is because a doubled-up shed provides cups for every cow standing in the shed instead of for only half of them. But, as cups have to hang idle when a batch of cows is moved out and another is moved in and prepared, fewer cows are milked per set of cups per hour.

So, despite the extra sets of cups per man in the doubled-up sheds, fewer cows were milked per man-hour in them than in the high-line single sheds. This is due to the extra work associated with hanging up cups between cows and to the increased number of batch changes.

For these two-man sheds there were approximately 12 cows per batch in the single type, and 7 in the doubled-up type. The herd size in each type was approximately 136, requiring 9 batch changes in the single sheds and 17 in the doubled-up sheds.

From the data obtained in this survey, it was concluded (Jackson and Murray, 1968) that for a given labour-force approximately one-third to one-half as many extra cups are needed in doubled-up herringbone sheds to give an output of cows per man-hour equivalent to that in high-line single herringbones.

This is in broad agreement with Holmes (1968) who suggested from work done with two types of installation in the same shed used by the same milkers to milk the same herd that, if a single high-line was to be converted to a doubled-up low-line an increase of 40% would be needed in the number of sets of cups if an equivalent output of cows per man-hour was to be achieved.

Cups were on cows for the longest time in the single sheds and for the shortest time in doubled-up sheds with low-line plant. If milk yield, milking characteristics and machine action were similar in both single and doubled-up sheds, then machines must have remained longer on cows in the single sheds after milk flow had ceased.

Handling a large number of sets of cups is not new, but more farmers may be attempting this as part of their efforts to increase productivity per man. As the number of cups per man becomes larger, the degree of overmilking may increase.

SETS OF CUPS PER MAN AND "CUPS-ON" TIME

Knowledge of the number of cups used per man does not make it possible to forecast for individual herds either the length of time cups will be left on the cow, or the number of cows milked per man-hour.

For a specified number of sets of cups per man, Whittlestone *et al.* (1957) pointed out that the shed with the shortest cups-on time is likely to milk the greatest number of cows per man-hour.

This is illustrated in Table 3, which shows the range in average cups-on time in different sheds of the same type and with the same number of sets of cups per milker.

If cups are left on cows too long, udder health may suffer and Brookbanks (1966) has used field survey information to show an association between high incidence

TABLE 3: RANGE IN AVERAGE CUPS-ON TIME BETWEEN HERRINGBONE SHEDS WITH THE SAME NUMBER OF SETS OF CUPS PER MAN*

	Washing & Stimulation Time (sec)	*Cups-on Time (min)*	*Cows Milked per Man-hour*
1962 Survey — one-man high-line single sheds			
6 sets of cups/man	24	8	42
	24	4½	85
8 sets of cups/man	26	7½	59
	14	5¼	81
1967 Survey — two-man sheds			
High-line single:			
5 sets of cups/man	32	7	36
	12	5	58
6 sets of cups/man	23	8	43
	17	5	60
High-line doubled-up:			
6 sets of cups/man	32	7½	31
	21	4¾	41
8 sets of cups/man	23	7½	37
	35	4¾	47
Low-line doubled-up:			
6 sets of cups/man	17	7¼	30
	13	4	41
8 sets of cups/man	18	6½	38
	17	4	52

*For each number of sets of cups per man, figures have been shown for the sheds with the longest and shortest average cups-on time.

of clinical mastitis and lengthy bail time. Bail time is calculated according to the method of Guss (1963) as:

$$\frac{\text{No. sets of cups} \times \text{Total milking time (min)}}{\text{No. of cows}}$$

Guss recommended that bail time should be less than 6 min/cow and Brookbanks compared this recommendation with the average figure of 8 min which he obtained for 16 herringbone and 130 walkthrough sheds. He suggested that in these sheds the lengthy bail time was due more to inefficient use of cups rather than from having too many per man.

The measure of average bail time may be a useful first check on the possibility of cows being overmilked in a shed for which total milking time is available but no individual milking times.

Bail time calculated in this way does not appear to be a good guide to average cups-on time if applied without knowledge of whether the shed is doubled-up or whether for some other reason cups are frequently hung up between cows.

A comparison of average cups-on time as timed to the nearest quarter minute, and average bail time calculated by the method of Guss, is shown in Table 4 for two-man herringbone sheds. The doubled-up sheds show the shortest cups-on time but the longest bail time.

TABLE 4: AVERAGE MEASURED CUPS-ON TIME COMPARED WITH AVERAGE CALCULATED "BAIL" TIME FOR TWO-MAN HERRINGBONE SHEDS OF DIFFERENT TYPES

Year of Survey	*No. of Sheds*	*Type of Shed*	*Cups-on Time (min)*	*Bail Time (min)*
1962	65	High-line single	6½	7.3
1967	33	High-line single	7	7.3
1967	28	High-line doubled-up	6	10.2
1967	30	Low-line doubled-up	5¼	9.6

DISCUSSION OF RESULTS IN DIFFERENT YEARS

(1) There has been a change in the type of milking shed used. In 1948, all sheds surveyed were of the walkthrough type. In the 1962 survey, there were in addition some tandems and a number of herringbones. By 1967, herringbones with doubled-up plant were arousing sufficient interest to warrant a survey comparing these types with the original herringbone.

Each year farmers using the artificial breeding services receive a postal questionnaire about a variety of their farm operations and since 1963 they have been asked whether their herds are milked in herringbone sheds (Anon., 1969). The replies showed that in the five seasons 1963-4 to 1967-8, the incidence of herds using A.B. which are milked in herring-bone sheds was 10, 15, 22, 31 and 40%, respectively. As the percentage of farmers using A.B. increases each year, the sample used in this survey represents a higher proportion of all dairyfarmers each year (40% of farmers used A.B. in 1963-4, 60% in 1968-9). Farmers using A.B. are different from other farmers in at least two characteristics; first, they use A.B. which may show they are more progressive in outlook, and, second, they have larger herds. For both reasons, they are more likely to change to

herringbone milking than are other farmers. Figures are not available for the number of herringbone sheds in use on all farms each year, but in 1965-66, when 22% of A.B. farms had herringbone sheds, the Dairy Division of the Department of Agriculture estimated that 15% of all milking sheds were herringbones (Clifford, 1966).

(2) A comparison of performance in samples of two-man high-line single herringbone sheds in the years 1962 and 1967 is shown in Table 5.

TABLE 5: PERFORMANCE IN TWO-MAN HIGH-LINE HERRINGBONE SHEDS

	1962 Survey (n = 65)	*1967 Survey (n = 33)*
Average no. cows/man	53	68
Average no. sets cups/man	4.4	6.1
Average no. cows/set cups	12.2	11.4
Average no. cows milked/man-hour	38	51
Average no. cows milked/set cups/hr	8.6	8.5
Average washing and stimulation time (sec)	24	18
Average cups-on time (min)	6½	7
Average milking time/herd (min)	85	81

In 1967 more cows were milked per man and more sets of cups were used per man. More cows were milked per man-hour and as a result total milking time was very similar despite the difference in number of cows per man. Less time was spent on washing and stimulation and there was an increase in the time cups were on cows.

In both these samples, the average number of cows milked per man-hour was considerably higher than in the 1948-9 sample of walkthrough sheds (single unit, 22 cows per man-hour; doubled-up, 26 cows per man-hour).

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