

Shortening the Length of Dairy Cow Machine Milking Grouping Animal in Function of Milk Extraction Rate

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Abstracts

The aim of the study is to examine the work organisation of routine milking a double herring bone milking parlour of a representative farm in the province of Ragusa (south-eastern Sicily), an area dedicated to quality milk and cheese production, in order to suggest solutions to the notable time losses reported in the literature due to the presence of very slow animals among the groups to be milked.

The farm was chosen on the basis that it represented those in the south east of Sicily, which area, as is known, is very much involved in animal farming. There are about 100 cows, of which during the study about 40% were in lactation while the rest were heifers and calves kept for fattening. The milking operations were carefully observed and subsequently broken down into constituent stages, which were timed. Particular attention was focused on the question of whether group milking times were increased by the presence of exceptionally slow animals.

As reported in the literature, in double herring bone parlours there are prolonged waiting times for cows with shorter extraction times. With regard to this, an elaboration of the data showed that the animals should be grouped according to their extraction rate as this parameter was found to be constant, reliable and independent of the quantity of milk produced. In short, the results indicate that a considerable amount of time can be saved if milking is organised in such a way as to reduce milk extraction times. Savings can be obtained both by establishing a rational way of taking the herd into the parlour for milking and by better work organisation. This represents both a more rational and economical use of the technological innovations (machines, equipment and plants) present on the farm and better work conditions for the operators in terms of greater comfort, safety and free time.

Key words

Herring-bone parlours, herd, work organisation

1. Objectives

The main aim of the research was to examine the work organisation of routine milking in a double herring bone milking parlour in order to suggest solutions to the notable time losses reported in the literature due to the presence of very slow animals among the groups to be milked.

This kind of milking parlour is spread in the province of Ragusa, which plays the role of guide for the rest of the Sicilian farms as it is the province that contributes the most to the dairy production of the island.

2. Materials e methods

The farm was chosen on the basis that it represented those in the commune of Ragusa, which, as

is known, is very much involved in animal farming. It breeds Frisian dairy cows and part of the milk produced goes to an association of producers called “*Cooperativa degli Altopiani*”, and part of it is made into cheese according to the procedures dictated by the standards for the production of “*Ragusa Cheese (PDO)*”. It has a surface area of about 33 ha (of which about 28 are used for growing grass). The 1000 m² covered area offers free housing in a stall with permanent litter. There are about 100 cows, of which during the study about 40% were in lactation while the rest were heifers and calves kept for fattening. There are no males on the farm and artificial fertilisation is used. The farm produces fodder which is mixed with protein concentrate and fed to the cattle with “*Unifeed*” techniques.

Mechanical milking is carried out using a “double herring bone (4+4)” plant, situated in a parlour which the cattle enter without any pre-established order from an adjacent fenced holding area through two gates manually controlled by an operator. The plant is made up of 8 milking stands and the milker’s pit. The passage way to the stands is 1.15 m wide and the stands are inclined at an angle of 30° with respect to the longitudinal axis of the room.

The *milking operations* were studied over a period of a year. The study regarded the productive performance of each animal, including the quantity of milk produced at each milking and the milk extraction rate. Aspects of the work organisation were also studied including routine and milking times with reference to single cows, groups and the herd. Particular attention was focused on the question of whether group milking times were increased by the presence of exceptionally slow animals. In fact, as reported in the literature, this is a drawback to the use of a double herring bone parlour, where the animals enter and leave in groups. Subsequently, after having ascertained the existence of the phenomenon and its frequency by evaluating the *mean milking times* of each cow, it was possible to simulate the formation of groups that were homogeneous as regards milking times, and thus calculate the *simulated cycle times*. The latter were compared with the cycle times that were actually observed in order to establish how much time could be saved by forming homogeneous groups.

3. Results

Parlour Performance

Out of a total of 64 studies carried out during a year, 27 regarded morning milking operations and 37 those in the evening. Each study involved 48 cows in lactation, divided into 12 groups of 4 cows each. Only one operator was present for milking.

The mean milking time of the herd – including all the routine operations from the entrance into the parlour of the first animal until the exit of the last – was on average 88 minutes. This is much less than the sum of the milking times of the 12 groups of 4 animals. In fact, since in the double herring bone plant two groups are milked at the same time, the total milking time for the herd is much lower than the product of the mean cycle time by the number of groups milked. The work capacity of the parlour was found to be 31 heads/h and the mean cycle time (for the execution of all the stages of the milking routine of each group) was 13.3min.

The phase with the longest mean time is represented by milk extraction (9.4 min), which is equivalent to 71% of the cycle time (fig. 1), while the remaining phases take much less time. In order to reduce the routine time and thus increase the double herring bone parlour performance, it might be possible to intervene at the stage when the operator is working. This, however, represents only 29% of the routine itself and does not appear to be reducible. A more realistic

possibility is represented by the possibility of forming groups of animals with the same extraction times so as to reduce the time spent in the parlour waiting for the slowest cow in the group. This has already been suggested in the existing literature. Obviously another indirect way to reduce times would be to increase the presence of cows with faster milking times by means of genetic selection.

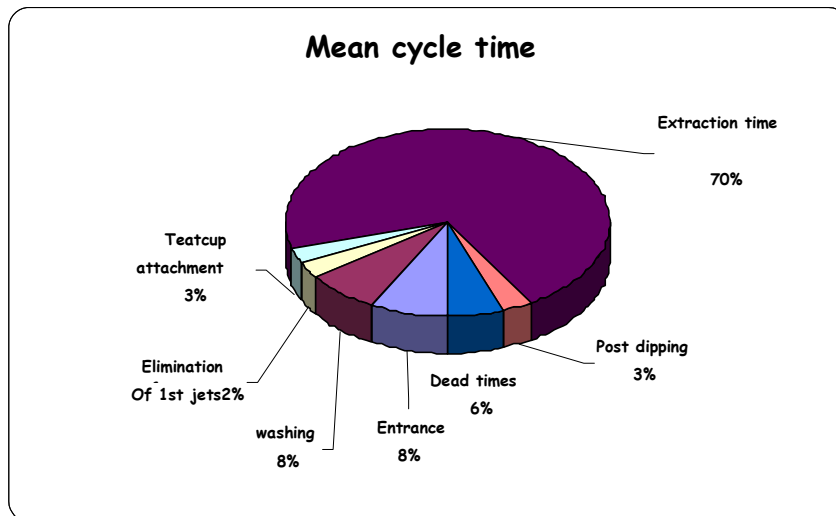


Figure 1

Formation of homogeneous groups

Identification of the parameter. By observing the individual stages of the milking routine, it was found that the parlour performance depends only to a very small extent on the work organisation and the operator's performance and to a much greater one on the milk extraction time, that is to say on the characteristics of the cow being milked. This observation confirms what is reported in the literature: animals that have already been milked remain in the parlour longer than necessary because of the presence of slower cows. An analysis of the data shows that on average about 280s passed from when the fastest cow had already finished being milked to when the whole group could leave the parlour. As a consequence, it was realised there was a need for a constant and reliable parameter that could be used to group the animals according to their milking times. This parameter was identified in the milking rate (l/min). In fact, from an analysis of the extraction times, it is possible to identify cows that are constantly characterised by a correspondence between low capacities and high extraction times or high capacities and low extraction times, regardless of how much milk is produced. Figure 2 shows the high correspondence between milking time and milk flow rate.

Medium-low capacities (1.2 l/min) corresponded with medium-high extraction times (10 min) and medium-high capacities (3.1 l/min) corresponded with medium-low extraction times (3.4 min); the amount of milk produced did not influence these times. From a practical point of view, an elaboration of the data shows that to establish the number of measurements necessary to determine the correlation between capacity and extraction times, the 5 initial observations would have been sufficient (tab. 1). Work in the parlour, therefore, can be organised by studying just a

few milking sessions and then forming homogeneous groups on the basis of extraction rate.

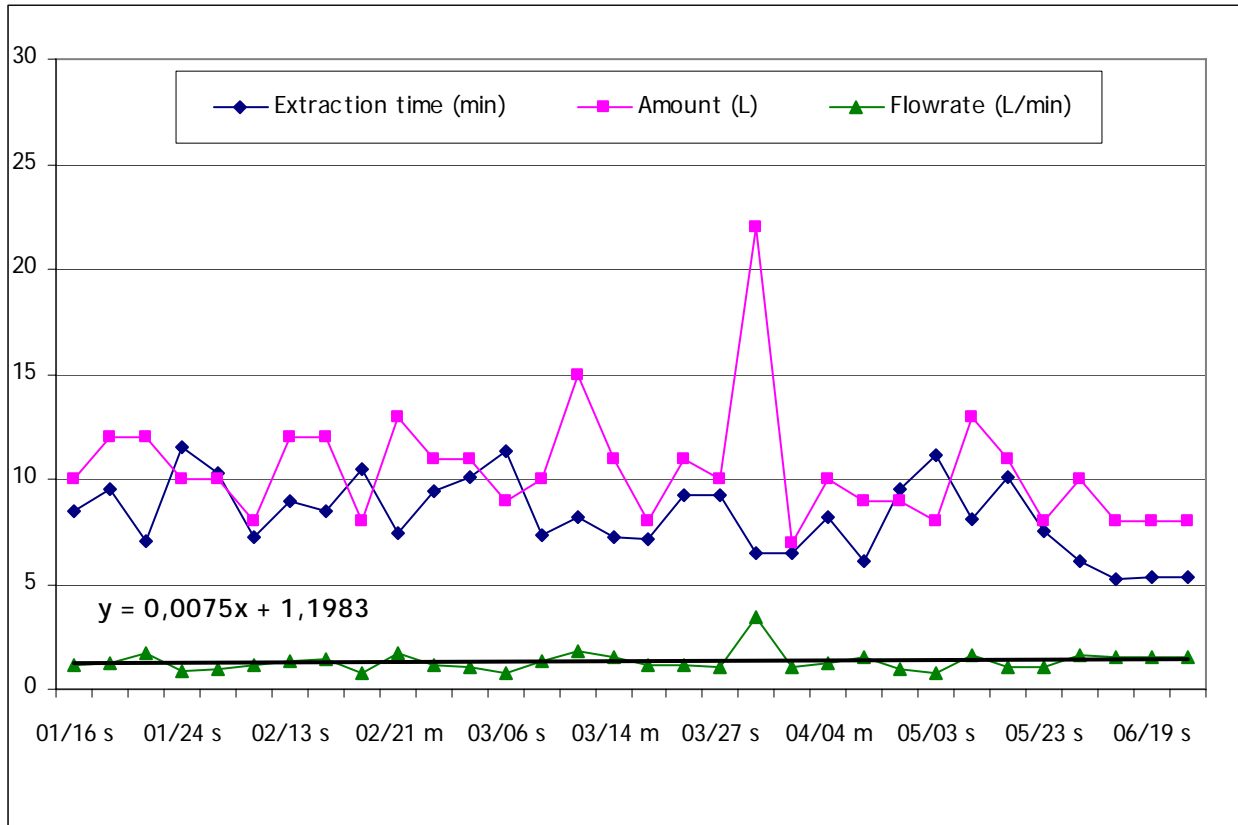


Figure 2

Table 1 - Calculation of extraction capacity based on three milking sessions

Denomination	Milk production (litres)	Extraction time (min)	Extraction capacity (l/min)
Slow cows	10	8,55	1,2
Quick cows	15	5,33	2,8

Simulated milking. Once both the relationship between the extraction times and rate, and the constancy - and therefore reliability - of the rate had been ascertained, it was possible to proceed with simulated milking, forming homogeneous groups on the basis of milking rate. From an elaboration of the data relative to the milking times for such homogeneous groups, it emerges that the mean milk extraction time is about 2 minutes less than that for the groups observed (11.2 as opposed to 13.2 min). Thus, the homogeneous groups took 21% less time to milk than the groups formed randomly. The waiting time of the fastest cow (on average 260s) was reduced to about 25s, representing a saving of 90%. Moreover, the extraction time for the simulated groups represents about 65% of the cycle time, this being less than the percentage calculated (71%) for the groups observed. This saving in time means that forming homogeneous groups for the

extraction stage reduces the cycle time for each group in the herd by about 15%. Moreover, from an elaboration of the data relative to the simulated milking, it was calculated that the parlour work capacity was 45 heads/h as opposed to 31 heads/h, this representing an increase of 45%. When the unit time was considered, the 1.8 min/head for the observed groups was reduced to 1.2 min/head for the simulated groups, this representing a saving of 30%.

Table 2 – Comparison of observed and simulated groups

Milking parlour performance		
	Observed	Simulated
Number of cows milked	46	46
Number of groups	12	12
Milking of the herd (min)	88	61
Work capacity (heads/h)	31	45
Unit time (min/head)	1,8	1,2

3. Conclusions e prospects

The observations made during the course of a year show the influence of various factors on the organisation of the milking, on the various stages of the process and on the execution times.

The results also show the large proportion of the total milking time taken up by milk extraction (71%). This indicates, among other things, that to reduce milking times it is necessary to reduce the milk extraction times, for example by grouping the animals in such a way as to reduce waiting times of cows in the group on completion of milking.

As reported in the literature, in double herring bone parlours there are prolonged waiting times for cows with shorter extraction times. With regard to this, an elaboration of the data showed that the animals should be grouped according to their extraction rate as this parameter was found to be constant, reliable and independent of the quantity of milk produced. In the trial situation, it was found that the results of only 5 milking were sufficient to calculate the extraction rate of each animal.

Also, the trials has showed that:

- measurements have to be started 8 -10 days after birth;
- only healthy herds have to taken in account;
- measurements can't overcome 300 days.

Having identified and quantified the milk extraction rate parameter, a milking session of groups made up of cows with similar extraction rates was simulated. Waiting times were reduced by 90%, with a corresponding decrease equal to 15% of the milking cycle time of each animal

Considering the entire herd, about 30% of the milking time (h/herd) was saved with simulation and the parlour work capacity (head/h) increased by 45%.

In short, the results indicate that a considerable amount of time can be saved if milking is organised in such a way as to reduce milk extraction times. Savings can be obtained both by establishing a rational way of taking the herd into the parlour for milking and by better work organisation. This represents both a more rational and economical use of the technological innovations (machines, equipment and plants) present on the farm and better work conditions for

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