

RESEARCH IN TIME BETWEEN MILKING INTERVAL AND VARIABILITY OF MILKING FREQUENCY USING MILKING ROBOTS

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Abstract. The aim of the research – to state how the milking frequency is adjusted in practice at robotized milking. Therefore, the milking frequency as well as the time between milking interval deviation from the adjusted values were investigated. The research was performed on the teaching and research farm of the Latvia University of Agriculture “Vecauce” where the cows are milked with the milking robots VMS of the company “DeLaval”. Driving of the cows to the robots is done using the selectively guided cow traffic feed first system. The research results show that milking with robots the adjusted time between milking intervals and the adjusted milking frequency do not effectuate. Besides, the milking frequency per day lowers but the time between milking intervals become longer. Most often the cows move to milking two or three times a day. Likewise, the time between milking intervals for every cow varies in a wide range, but in 95 % of cases the variations do not exceed seven hours.

Keywords: automatic milking system, time between milking interval, milking frequency.

Introduction

Due to purposeful selection work and wholesome feeding of animals during the last 25 years essential increase of cow productivity has been achieved. If in the eighties of the last century the milk yield 5000-6000 kg·year⁻¹ was considered to be a good result, then today on the best farms the milk yield reaches 10 000 kg and more. This progress has caused great changes in the milk production technology including milking.

First of all the approaches to the milking frequency per cow per day were revised. It has been proved a long time ago that the between milking intervals can influence the productivity of cows. If the cows are milked three times per day, then, compared to 2xdaily milking, the milk yield increases by 3-10 %, but transferring to 4xdaily milking – by 5-10 % more [1].

It has been proved practically that at small or medium milk yields the 2xdaily milking is enough and it does not cause essential economic losses. But the situation changes milking highly productive cows. They react to the changes of the between milking intervals more sensitively as prolongation of this interval can cause slowing of the milk synthesis process. At the same time it should be mentioned that at very short between milking intervals it is not possible to arouse a valuable milk ejection reflex and therefore the milking process is disordered. Besides, it has been proved that the between milking interval should not be less than 4-5 hours.

Therefore, a conclusion can be drawn that the cows with a small milk yield can be milked twice a day but productive cows should be milked 3 or 4 times a day [1]. But using traditional milking technologies it cannot be ensured due to high labour-intensity.

The development of the new milking technology has been stimulated not only by the necessity to increase the number of milking but also by different reasons of economic and social character. In this respect the issue of labour force should be mentioned. Although in recent years the salaries for the workers have considerably increased, still it is difficult to find good milkers as milking is hard physical work that should be done early in the morning and late in the evening.

All of these problems are rationally solved by milking with automated milking equipment or milking robots. Therefore, their number increases with every year and at present it approaches already ten thousands in the world.

Milking with robots cardinally differs from milking with the traditional milking equipment as the robots are completely automated milking equipment. The cows can visit them independently at any hour of the day without direct participation of people.

Milking with robots the between milking interval for every cow is adjusted individually depending on its milk yield and lactation phase. It means, that during this interval the cow is not allowed to enter the robot, but if it has entered, it is not milked.

Introduction of the new technology brings about several questions the investigation of which could give a more complete insight in the advantages and disadvantages of robot application:

- Does the introduction of the between milking intervals ensure achievement of the planned aim, that is, is the necessary milking frequency ensured per day?
- How long after receiving permission for milking the cows are slow to enter the robot?
- What is the delay dynamics?

By now these questions have not been specially investigated. Only partially they have been touched upon in the scientific publications of Koning [2], Hogeveen [3] and Artmann [4; 5].

Therefore, the aim of our research was to state how the milking frequency adjustment is implemented in practice milking with robots.

For this purpose two research tasks related to robotic milking were set:

- To state if the milking frequency deviates from the adjusted values and what the character of this deviation is;
- To clarify if the between milking intervals deviate from the adjusted values and how it manifests.

Materials and methods

The research was carried out on the teaching and research farm of the Latvia University of Agriculture “Vecauce” where the cows are milked with two milking robots VMS of the company “DeLaval”. There for driving of cows to the robots the selectively guided cow traffic feed first system is applied. Therefore, the cows from the lyng area can get into the feeding area only through the one-way gate. To get back to the recreation area the cows need to go from the feeding area through the pre-selection gate where they are driven to the waiting box (if the programmed milking time is due) or back to the recreation area. In turn, the milked cows get back to the feeding area and going through the pre-selection gate once more they can get back to the recreation area (Figure 1).

The milking procedure is supervised by the cattle-breeder on duty. The duties of the cattle-breeder include encouraging of the “lazy” cows to go to milking if their between milking interval according to the reading of the computer management system considerably exceeds the adjusted value. Though, driving of cows is not his basic job.

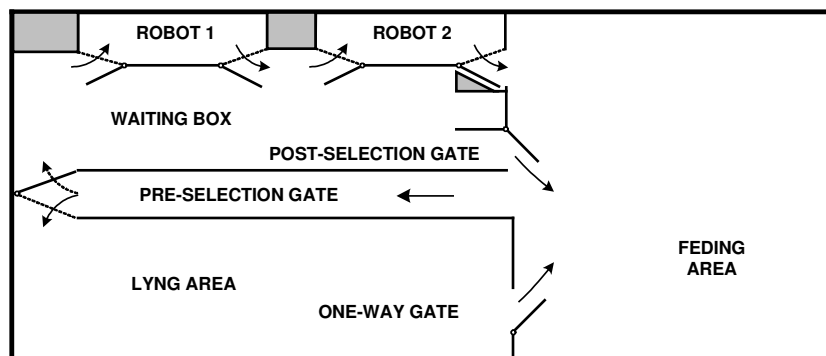


Fig. 1. Milking area design on the farm

All the necessary data for the research are taken from the robot management system and after that processed with Microsoft office software.

The data were summarized about a period of seven days. The researched group of animals included 87 cows and the average milk yield of the herd was 7000 kg·year⁻¹.

Results and discussion

The research results are summarized in Figures 2 and 3, and in Table 1.

Figure 2 shows the actual average milking frequency per cow per day at the corresponding adjustment of the milking frequency and also its variations during the whole period of the experiment.

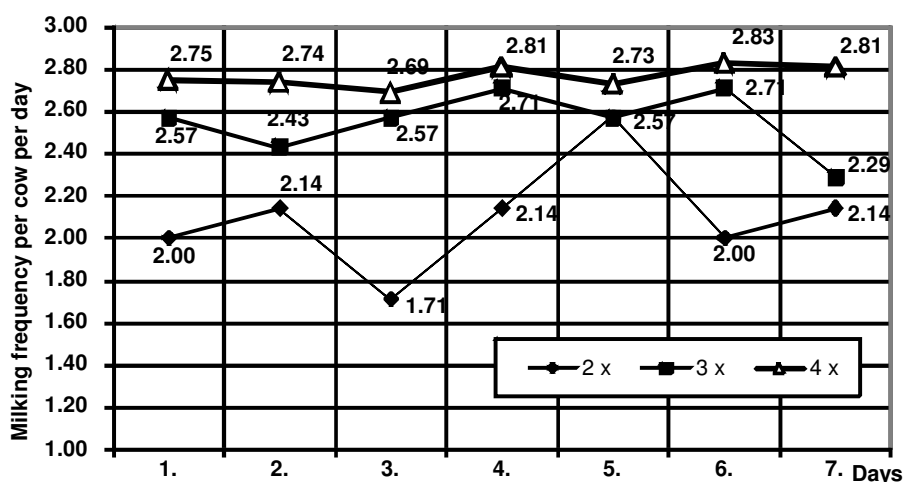


Fig. 2. Changes of the milking frequency per cow per day depending on the adjustment of the milking frequency

Table 1 depicts the distribution of the cows in groups according to the adjusted milking frequency for the corresponding group and the proportional distribution according to the actual milking frequency per cow per day in the whole period of the experiment.

Table 1

Distribution of cows according to the actual milking frequency per cow per day in the whole period of the experiment

Indices	Group with milking adjustment			
	2 x and 2.5 x per day	3 x per day	4 x per day	
Number of cows in the group	7	7	62	
Average milking frequency per cow per day	2.10 ± 0.26	2.55 ± 0.15	2.77 ± 0.05	
Distribution of cows, % ± δ, according to the actual milking frequency per cow per day	1 x	8.2 ± 4.3	0.0	0.9 ± 0.0
	2 x	73.5 ± 15.3	44.9 ± 15.3	39.6 ± 5.0
	3 x	18.3 ± 15.5	55.1 ± 10.6	41.5 ± 7.4
	4 x	0.0	0.0	18.0 ± 3.6

Figure 3 shows the distribution of the cows according to the actual milking frequency per cow per day for the group with the adjustment 4x daily milking.

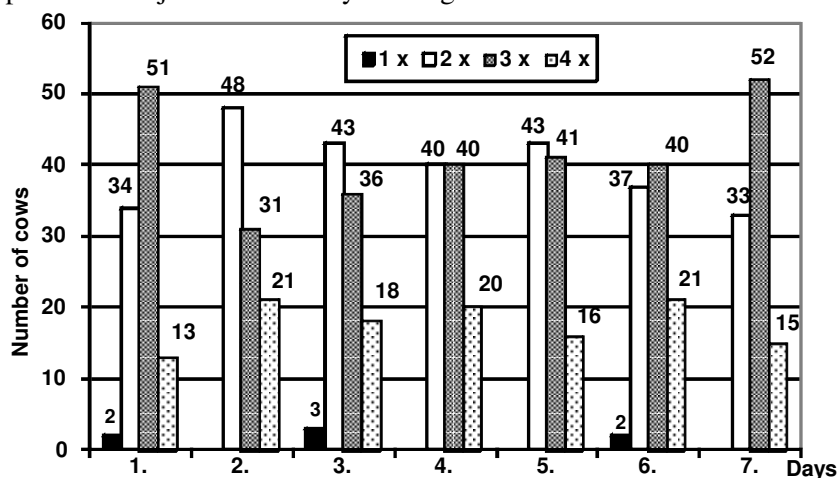


Fig. 3. Distribution of the cows according to the actual milking frequency per cow per day for the group with the adjustment 4x daily milking

Figures 2 and 3 as well as Table 1 show that the actual milking frequency per cow per day does not correspond to the adjusted. If, for instance, the adjustment is 4xdaily milking, actually in 0.9 % of cases the cows have been milked only once per day, 39.6 % of cows – twice a day, 41.5 % of cows – three times a day and only 18 % of cows four times a day.

The research results on deviation of the between milking intervals from the adjusted values are summarised in Table 2 and Figure 4.

Table 2 shows the distribution of the number of cases in hours when milking deviates from the adjusted between milking interval and milking is delayed.

Table 2

Number of cases when the adjusted between milking interval deviates from the adjusted value in separate research days

Delay, h	Research days						
	1	2	3	4	5	6	7
0-1	77	73	75	85	79	92	88
1-2	42	39	27	37	50	43	37
2-3	20	19	28	27	15	18	23
3-4	23	15	12	25	22	11	13
4-5	26	37	26	21	23	28	35
5-6	17	22	31	22	25	25	18
6-7	13	10	13	13	10	13	16
7-8	4	10	7	6	5	3	4
8-9	3	1	2	3	4	5	2
9-10	3	-	1	2	-	-	-
10-11	-	-	-	-	1	1	-
11-12	-	-	-	-	1	-	-
>12	-	-	3	-	1	-	1
Total	228	226	225	241	236	239	237

The average between milking interval deviations from the adjusted values stated in the whole period of the experiment are summarized in Figure 4.

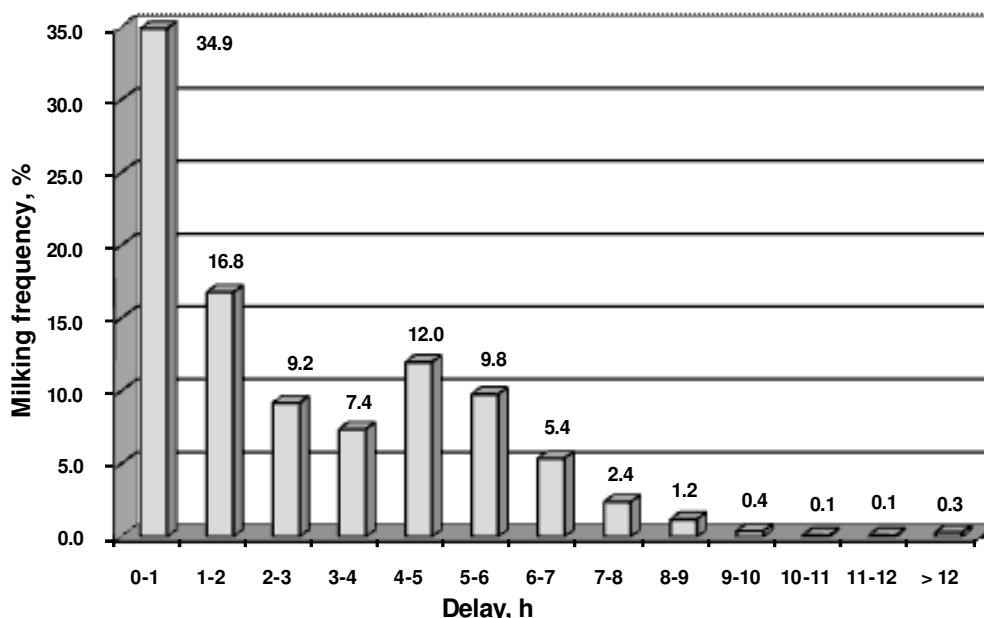


Fig. 4. The average between milking interval deviations from the adjusted values stated in the whole period of the experiment

The research results show that milking in robots does not go according to the plan, that is, the cows are not milked so many times a day as it is adjusted. As it can be seen in Table 2 the cows that

were planned to be milked four times a day have been milked only 2.77 times, but the cows with the adjustment 3xdaily milking – 2.55 times. The situation is better in the group of two and two and a half adjustment where the cows were milked in the average 2.1 times.

It proves that complete compliance of the milking frequency with the adjusted values has not implemented even in the situation when the slow cows now and then are driven. Besides, this problem becomes more topical if we wish to milk the cows three or four times a day. But it is not so essential milking the cows twice.

As it can be seen in Table 2 and Figure 4, milking with robots the adjusted between milking intervals are exceeded, that is, the cows are milked later as planned, but in 50 % of cases the delay does not exceed two hours, in 75 % of cases – five hours, but in 95 % of cases – seven hours. In separate cases the delay is even longer, but they do not occur often.

As it is known from the cow lactation physiology, the milking frequency is only a secondary value. The between milking interval, its length and consistency are more essential factors. Our research shows that the between milking interval using robots is a changing variable. It changes considerably for every cow and it is not constant. Therefore, further research in lactation physiology to determine how the hypothesis on the increase of cow productivity milking with robots implements.

Conclusions

1. Milking cows with robots the adjusted between milking intervals and the milking frequency per cow per day are not implemented: the between milking intervals become longer, but the milking frequency per cow per day decreases. Most willingly the cows move to milking two or three times a day.
2. The between milking intervals vary in a wide range, but in 95 % of cases the delay is within seven hours.
3. In order to ensure possibly closer approach to the adjusted milking frequency per cow per day and obtain the adjusted between milking interval, active participation of people is necessary driving the cows to the milking robots.

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