

## MILKING FREQUENCY IN MILKING ROBOTS WITH FEED FIRST COW TRAFFIC

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**Abstract.** Last year the first robotized milking machines were introduced in Latvia. Their main peculiarity lies in the fact that cows are milked without the help of people. The animals can go to the milking place independently at their own will and at any time of the day. After milking they can move to the feeding zones as well as to the recreation zones. For trafficking of animals from one functional zone to another several solutions have been elaborated. On the training and research h farm “Vecauce” of the Latvia University of Agriculture where the research was carried out the cows are milked by two robots and the feed first cow traffic system is applied. In this case the cows can get to the concentrated feed feeding zone going through the sorting gate. Here the animals are identified and the necessity for milking is evaluated and depending upon it the cows are directed to the pre-milking area or to the zone where the concentrated feed distribution stands are located. In Vecauce also another innovation is introduced – the cows after leaving the first robot get back to the pre-milking area and only after that through a separate sorting gate they can get into the feeding zone. The aim of our research was to state how often the cows attend robots during a day and to evaluate the cow traffic system applied in Vecauce. In the research it was stated that the cows are milked in robots in the average 2.9 times a day. But the trafficking of cows milked in the first robot to the feeding zone through the pre-milking area is not rational as a part of the milked cows return to the robot repeatedly so increasing the load of this robot. In order to eliminate this disadvantage proposals have been developed for reconstruction of the pre-milking area and for improvement of the animal trafficking system.

**Key words:** milk cows, robotic milking, milking frequency, cow trafficking system.

### Introduction

The technological process of milking using robots cardinally differs from traditional solutions. In this case the cows can move to milking at their own will at any time of the day and can be milked without participation of people.

At present in Latvia there are six milking robots VMS of the company DeLaval operating. Four of them were assembled and started to operate last year: two in Blome village, Valmiera region and two more in the newly built barn of the training and research farm “Vecauce” of the Latvia University of Agriculture. Besides, at the beginning of this year two robots were introduced in operation on a milk farm at Mazsalaca.

Nevertheless, in Latvia still there is not a special experience in application of such robots and there are many uncertainties in relation to rational application of this new technology.

The aim of our research was to state the cow milking frequency using robotized technology as well as to evaluate the cow trafficking solution in Vecauce from one functional zone to another.

It should be noted that such investigations have already been carried out in the countries where robots are largely used [1, 2, 3], but the results obtained by the researchers have considerable differences that can be explained by the peculiarities in milk farming in different countries.

### Research object and methods

The research was carried out on the newly built milk farm “Līgotnes” on the training and research farm “Vecauce” of the Latvia University of Agriculture. On this farm the cows are housed in four separate sections. The cows in one section are milked by two company *DeLaval* robots *VMS-2007* (Fig. 1), but the animals housed in the other three – at the milking area using the stand type equipment with parallel location during milking.

For trafficking of cows to the milking robots on the farm “Līgotnes” the feed first cow traffic technology is applied. It means that for stimulation of this traffic access to mixed concentrated feed that is especially tasty for cows is used. As it can be seen from the figure in this case the barn section is divided in four functional zones: milking, feed mixture feeding, recreation and concentrated feed feeding zones. Cow trafficking from one zone to another is organized by means of the sorting gate 16, selection gate 15, and one direction gates 8 and 17.

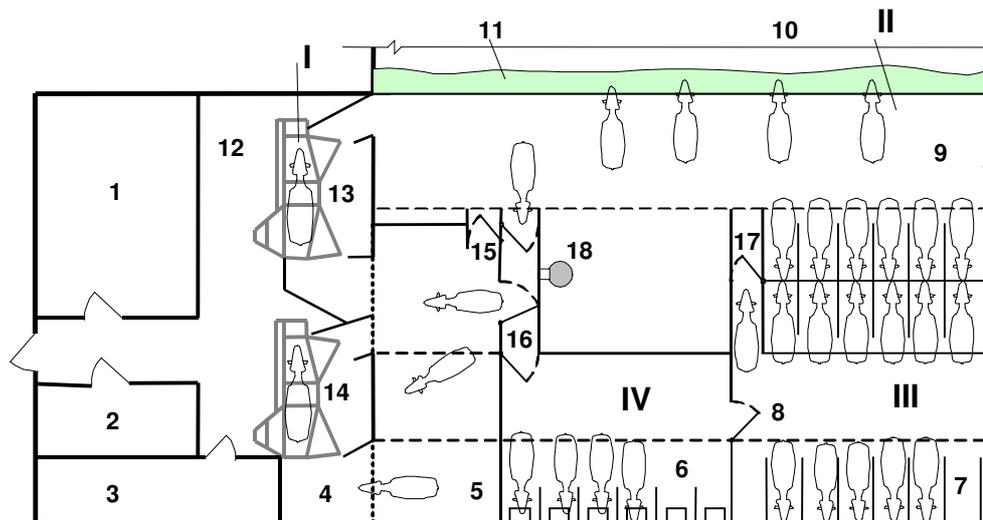


Fig. 1. **Section design and location of technological equipment using milking robots:** I – milking zone; II – feed mixture feeding zone; III – recreation zone; IV – mixed concentrated feed feeding zone; 1 – milk area; 2 – computer room; 3 – technical corridor; 4 – pre-milking room; 5 – pre-milking area; 6 – mixed concentrated feed feeding stands; 7 – row of boxes; 8 – one direction gate; 9 – manure passage; 10 – feeding table; 11 – feed mixture; 12 – corridor; 13, 14 – milking robots; 15 – cow selection gate; 16 – cow sorting gate; 17 – transition corridor with one direction gate; 18 – rotating brushes for treating cow bodies

In order to get into the mixed concentrated feed feeding zone the cows need to go through the sorting gate. There the animals are identified (the given number is identified) and the necessity for milking is evaluated. If the limited time after the previous milking for the definite cow has passed (during the experiments – 6 hours) the sorting gate directs the cow to the pre-milking area, but if this time is less and the cow does not need to be milked it is directed to the concentrated feed feeding zone. The robot attendance limiting time is substantiated by investigations [1]. They show that milking cows more than 4 times per day it is not possible to get considerable increase in milk yield and it only reduces the efficiency of using robots. Therefore, it is possible to assume that the desirable limiting time is 6 hours as then the number of attending robots is in the average 2.5 – 3.0 times per day.

If the cow has got into the concentrated feed feeding zone it can consume its ration of concentrated feed that is meant for it in that definite moment at the concentrated feed feeding stands but after that it can move through the one direction gate back into the recreation zone where cow recreation boxes are located. If, in turn, the cow has got into the pre-milking area it should stay there until the robot is free.

During milking the cows receive a ration of concentrated feed set before (during the experiment 3 kg) but after milking they are let to go back into the feed mixture feeding zone. Nevertheless, here is a peculiarity that the cows that have been milked by the first robot can get into the feed mixture feeding zone moving through the pre-milking area and selection gate 15. Also the cows that are in the recreation zone can get into the feed mixture feeding zone going through the one direction gate 8. So the cows can traffic during twenty four hours unlimited times from one functional zone to another (according to the above described scheme) depending on their own will.

Compared to free and semi-free cow traffic technologies the feed first cow traffic technology has several advantages:

- for trafficking of cows to the milking robots their wish to get mixed the concentrated feed that is tasty is used;
- cows that do not need to be milked in the definite period of time cannot get into the pre-milking area.

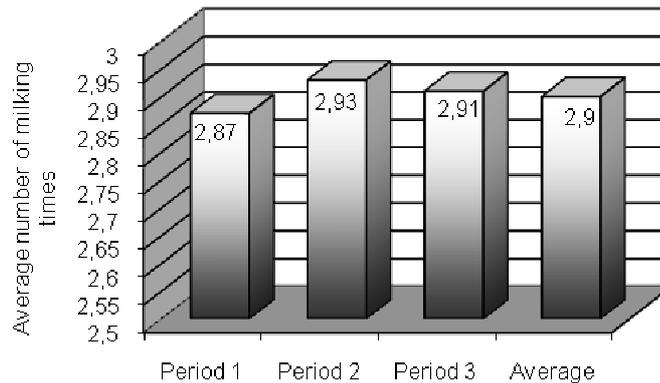
The experiments were made 1.5 months after introduction of robots when the cows had got used to the new handling and milking conditions. The research lasted for 45 days (from October 1 till

November 15) and they were divided in 3 periods (15 days each). During this time there were in the average 73 cows in the section.

In the experiment the data obtained every day from the robot control computer were used. The average number of milking times per day was stated and the average number of attendance of the robot by the cows of the group was calculated. Also the traffic of cows to milking and back to the feed mixture feeding zone was investigated paying special attention to repeated attendance of the robot immediately after milking.

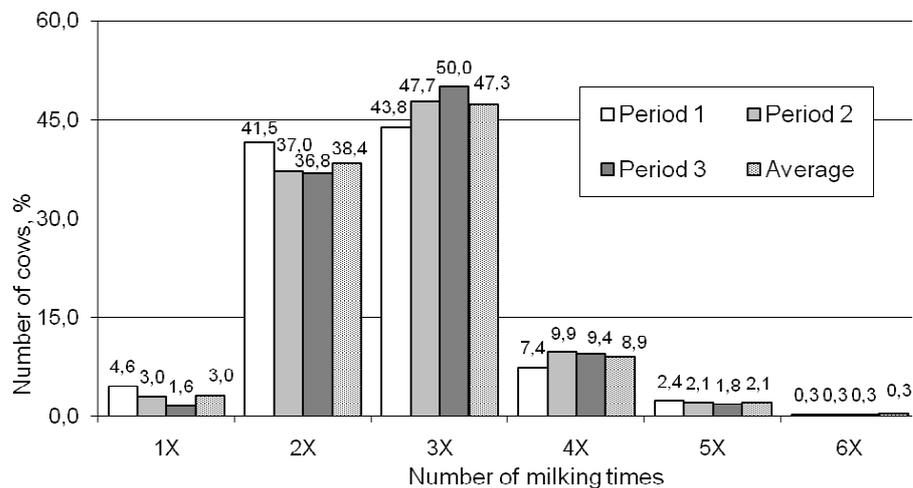
**Results and discussion**

The average number of milking times per day for the group of cows milked by robots can be seen in Fig. 2.



**Fig. 2. The average number of the cow group milking times per day**

It can be concluded from the figure that the cows have attended the milking robots in the average 2.9 times per day. Such number of milking times complies with the optimal and recommended interval (2.5-3.0 milking times) that has been obtained in the investigations carried out in Germany [1]. More detailed description of the technological process is given in Fig. 3 where the division of cows according to the milking times per day is shown.



**Fig. 3. Division of cows according to the milking times per day**

From the research results it can be seen that during the whole period of investigations 8.9 % of cows have been milked four times, 4.7 % – three times, 38.4 % of cows – two times, but 3.0 % of cows – only one time. Cows with high milk yield should be milked three and four times, but the other cows – two times. Nevertheless, in the data recorded in the computer it is not considered that in the herd about 3 % of cows are not attending the robots willingly and they have to be especially stimulated. Besides, such situation is common as it has been stated also in the research of other scientists [3]. But it does mean that milking using robots has to be controlled regularly (2 times per

day) in order to stimulate the “lazy” cows. If it is not done the robot attendance would be accordingly less.

Also the fact that separate cows have been milked five and six times draws attention. Judging from the limiting time set in the robot control computer (6 hours in between milking) it is not really possible. Therefore, we can draw a conclusion that these cows have been milked in the first robot where the animals after milking return back to the pre-milking area and they can omit going through the selection gate to the feeding zone but repeatedly come back to the robot. It proves that the above assumption that all cows after leaving the milking robot will go to the feeding zone is not correct. Besides, repeated returning of the milked cows to the robot is not desirable as it artificially increases the robot load and decreases the number of actually milked cows.

This drawback can be eliminated. For this reason the design of the pre-milking area has to be changed (Fig. 4). The selection gate through which the cows leave the pre-milking area has to be moved to the entrance into the milking zone and additional one direction gate should be installed for leaving from the milking zone. Also more complete separation of the robots (with barriers or walls) from the pre-milking area is needed.

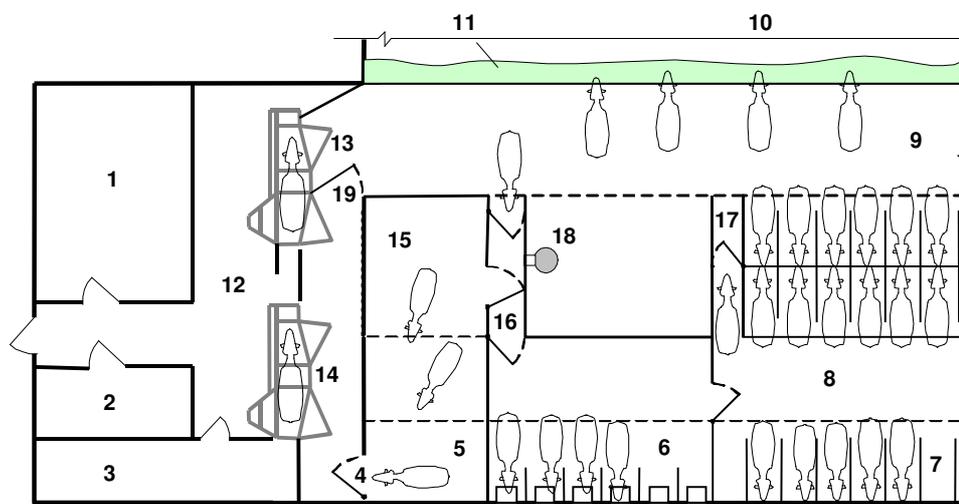


Fig. 4. **Proposal for reconstructed pre-milking area:** 19 – additionally installed one direction gate (other designations correspond to Fig. 1)

## Conclusions

1. The cows attend the milking robots in the average 2.9 times per day that complies with the optimal and recommended interval (2.5-3.0 times per day). Besides, 8.9 % of cows have been milked four times, 47.3 % – three times, 38.4 % – two times but 3.0 % of cows – once a day.
2. In order to prevent repeated attendance of robots of the cows milked in the first robot the pre-milking area should be reconstructed moving the selection gate to the milking zone entrance additionally installing one direction gate at the exit from the milking zone and separating the robots from the pre-milking area with an additional barrier.

## References

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