

## COW TRAFFIC DYNAMICS USING MECHANICAL MOVERS

Maris Mangalis, Dzintars Jaundzeikars, Juris Priekulis

Latvia University of Agriculture

maris.mangalis@inbox.lv, juris.priekulis.@llu.lv

**Abstract.** The article describes the cow traffic dynamics from the waiting yard to the milking parlours using mechanical movers. If the mechanical movers are not used, the cows must be driven by the animal breeders – cow drivers, but it is related to considerable consumption of work. In the research it has been stated that the mechanical movers are practically indispensable using the rotary type milking equipment as in this case continuous traffic of animals should be guaranteed to the milking places. To ensure this, in Latvia cow mechanical movers Cow Mander 600/700 are used that gather concentration in the waiting yard up to 1.1-1.2 m<sup>2</sup> per animal. Nevertheless, it exceeds the recommended concentration 1.5-1.6 m<sup>2</sup> per animal. If the side by side type milking equipment is used with cow group allowance in the milking places, the task of the cow mechanical mover is to reduce the part of the waiting yard occupied by cows concentrating the animals near the entrance into the milking parlour. In that case the mechanical movers can be operated in manual regime ensuring concentration 1.5-3.0 m<sup>2</sup> per animal. Usage of such solution reduces the consumption of work necessary for driving cows for about two times.

**Keywords:** milking of cows, mechanical movers, concentration of cows, cow traffic dynamics.

### Introduction

In Latvia mechanical movers are introduced in the recent years. They are used mainly in large sheds where cows are milked with side by side type milking equipment.

Cow mechanical movers are used to ease the work of people driving cows from the waiting yard to the milking parlour. If a mechanical mover is not used, the cows must be driven by stockbreeders – cow drivers. It is related to considerable consumption of time. Therefore, the main task of mechanical movers is to reduce the number of people working in milk farming [1].

Cow mechanical movers are necessary if cows are milked with rotary type milking equipment as in that case continuous animal traffic to the milking places in the parlour should be ensured with cows moving one after another.

If, in turn, herring-bone or side by side equipment is used for milking, animals must enter the milking places in a group. Therefore, in this case cow traffic from the waiting yard to the milking parlour is periodical – after milking of the corresponding group of cows. Therefore, the task of the mechanical mover is to concentrate the unmilked cows near the entrance to the milking parlour preventing scattering of cows along the whole waiting yard and promoting their adequately fast entrance into the milking parlour.

The aim of the research was to state: what is the cow concentration in the milking yard using mechanical movers and how this concentration influences the cow traffic to the milking places.

### Materials and methods

For the research five milk farms were selected. On four of them cow mechanical movers are used but on the fifth people worked without mechanical movers, and it served for comparison of the research results.

On all farms cows were handled in cold sheds using recreation boxes and the cows were milked two times per day in a separate parlour. On the farms the number of cows, the type of the milking equipment used, farm design and organization of milking differed.

Characterisation of the milk farms included in the research is given in Table 1.

In the research the cow traffic intensity entering the milking parlour as well as concentration of cows in the waiting yard were stated. To do that, on every farm one morning and one evening milking were timed.

If the rotary type equipment was used for milking, every ten minutes the number of cows entering the milking equipment as well as the part of the waiting yard occupied by the cows was stated.

Table 1

**Characterisation of farms included in the research**

Indices		Name of the farm				
		Company "Tērvete"	Company Ltd. "Līvberze"	Farm "Rudeņi"	Company Ltd. "Lestene"	RTF "Vecauce"
Number of cows		800	600	300	315	313
Milking equipment		Rotarymilking Side-by- SideSystems - 80	RotarymilkingSi de-by- SideSystems - 50	Rotarymilking herringborneS ystems - 20	Side-by- SideParlours 2 x 16	Side-by- SideParlours 2 x 10
Cow mover		CowMander 600/700	CowMander 600/700	CowMander 015	Herdsmen HRS	-
Number of milkers		4	2	2	2	2
People involved in moving cows:	drivers	2	1	1	2	1
	milkers	0	0	0	0	1*

\* milkers drive the cows in the milking places when the groups of cows are changing

If side by side milking equipment with side by side or herringbone location was used on the farm, the size of every fixed subgroup of cows was corresponding to the number of milking places at one side of the milking parlour. Entering the parlour was considered to be the time from the moment of opening the entrance gate till entrance of the last cow of the subgroup into the parlour. The animal concentration was determined after entrance of every subgroup of cows in the milking parlour registering the number of cows left in the waiting yard and the squaring of this area.

For stating the cow concentration the following formula was used:

$$\Delta = \frac{z_g}{b_l \cdot l_l}, \quad (1)$$

where  $\Delta$  – cow concentration in the moment of recording, cows per m<sup>2</sup>;

$z_g$  – number of cows in the waiting yard in the moment of registering;

$b_l$  – width of the waiting yard, m;

$l_l$  – length of the waiting yard occupied by the cows in the moment of registering (distance from the entrance into the milking parlour to the mechanical mover), m.

**Results and discussion**

In the research the hypothesis proved to be true that the character of the cow traffic from the waiting yard to the milking equipment depends on the type of the used milking equipment.

If cows are milked with rotary type milking equipment in that case continuous animal traffic should be ensured with cows moving one after another as with the equipment turning all vacant milking places are occupied. Therefore, the cow traffic intensity is determined by the speed of the equipment and different side reasons that can interfere with cow milking causing a necessity for short stoppage of the equipment. For instance, situations when the time of milking exceeds the time of one turn of the equipment. The cow traffic intensity stated in the research using rotary type milking equipment is shown in Figure 1.

The recording results show that on the farms "Līvberze" and "Tērvete", where the cow mechanic movers Cow Mander 600/700 were used in automatic operation regime, the cow traffic speed at the entrance to the milking parlour reached 7-9 and 9-11 s per cow. But on the farm "Rudeņi" where the cows were driven to the milking places by a person the mechanic mover was operated manually. Therefore it was operated periodically to reduce the part of the waiting yard occupied by the cows. Nevertheless, in this case the average traffic intensity reduced more than two times reaching in the average 23 s per cow.

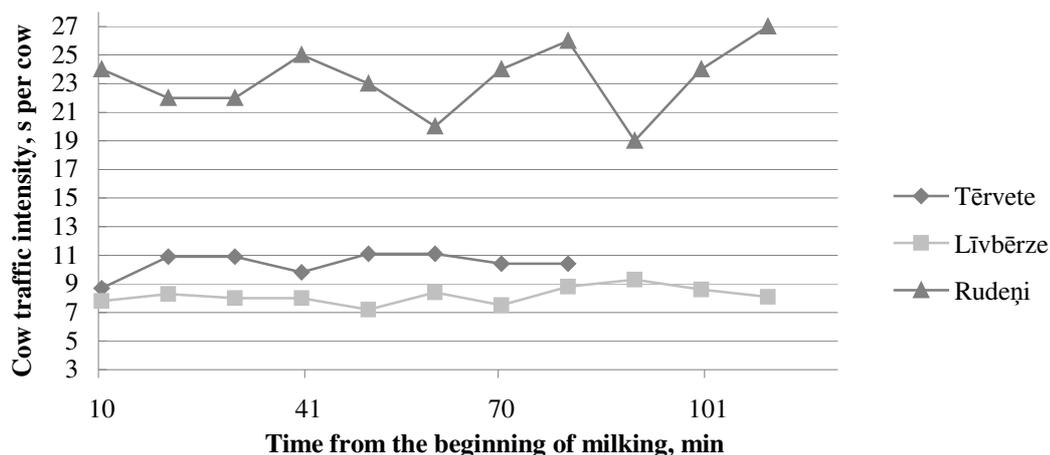


Fig. 1. Cow traffic intensity changes depending on the time from the beginning of milking using rotary milking equipment

The changes of the cow concentration in the waiting yard using the rotary type milking equipment can be seen in Figure 2.

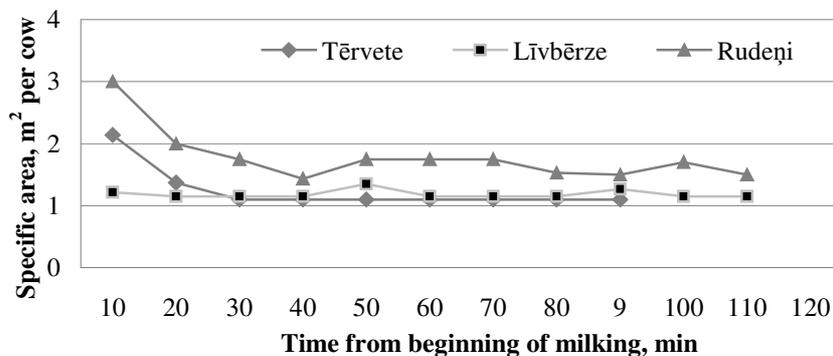


Fig. 2. Dynamics of changes of cow concentration specific area in the waiting yard using rotary type milking equipment

It can be seen in the figure that the area of the waiting yard occupied by the animals calculating per one cow at the beginning of milking is larger, but then it gradually reduces and becomes stable. In turn, in Figure 1 it can be seen that the cow traffic intensity at the beginning of milking is larger than average. It can be explained by cow herd hierarchy as in every group there are leading cows with a higher hierarchy range and getting into the waiting yard they go to milking independently. After the animals are packed enough, lower range and more timid cows are milked. Therefore, determining the cow concentration, the data obtained after stabilization of the curve characterizing the concentration should be considered.

Using the rotary type equipment and the hard type cow mechanical mover CowMander 600/700 the cow concentration in the waiting yard reaches 1.1-1.2 m<sup>2</sup> per animal. It ensures the cow traffic (one animal after another) through the entrance into the waiting yard in compliance with the rotation speed of the equipment. But this way of cow concentration exceeds the amount of concentration indicated in the recommendations – 1.5-1.6 m<sup>2</sup>, calculating per one animal [2; 3].

If for milking side by side or herringbone type location is used, the animals get into the milking parlour in separate groups the size of which depends on the number of milking places in the corresponding milking equipment. Average length of one cow entering in every such subgroup and separate farm can be seen in Figure 3.

As it can be seen in the figure, using equipment with cow group entering the milking places, the entering time of separate cow groups can differ by 30-40 % as it depends on the work of the people involved in cow driving and the technical equipment. If the cows are driven by a person (cow driver), the average consumption of time calculating per one cow is about 9 s, but using also the mechanical mover as it is in the company “Lestene” this consumption of time can be reduced two times, i.e., up to

5 seconds calculating per one animal. It is so because by help of the mechanical mover it is possible to reduce gradually the area of the waiting yard occupied by the cows concentrating the animals near the entrance to the milking parlour. Besides, it should be mentioned that usage of the mechanical movers is especially important at the end of milking when there is a small number of cows in the waiting yard and they have scattered along the whole area of the waiting yard.

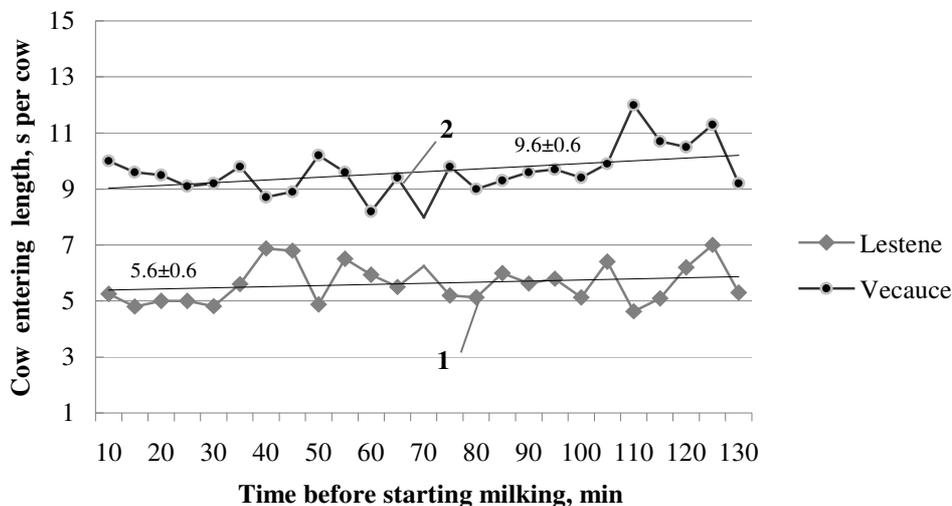


Fig. 3. Average length of one cow entering the milking place using side by side (SIA “Lestene”) and (MPS “Vecauce”) milking equipment: 1; 2 – average cow entering length

## Conclusions

1. Using the rotary type milking equipment and hard type mechanical mover CowMander 600/700 the concentration of cows in the waiting yard reaches 1.1-1.2 m<sup>2</sup> per animal. It ensures the cow traffic (one animal after another) through the entrance into the waiting yard in compliance with the rotation speed of the equipment. But this way of cow concentration exceeds the amount of concentration indicated in the recommendations – 1.5-1.6 m<sup>2</sup>, calculating per one animal.
2. If the rotary type milking equipment and light type cow mechanical mover Cow Mander 015 that is not operated in mechanical regime are used, the cow concentration in the waiting yard is in the range from 1.5 to 3.0 m<sup>2</sup> per animal, but for cow driving to the milking parlour a person – cow driver is needed.
3. After entrance of a new cow into the waiting yard intensive enough moving of animals for milking is at the cow concentration 2-3 m<sup>2</sup> per animal as in every group there are leading cows with the highest hierarchy range who independently go for milking.
4. If side by side type milking equipment is used with groups of cows entering and the mechanical mover is not used, the consumption of time necessary for filling the milking places with new cows increases for about 5 to 9 s calculating per one animal, besides, the load for the people involved in cow driving considerably increases.

## References

1. Приекулис Ю., Мангалис М. Исследования выгодности применения механических подгонщиков при доении коров. / Проблемы интенсификации животноводства с учётом пространственной инфраструктуры и охраны окружающей среды. Монография под научной редакцией проф.В Романюка. Институт технологических и естественных наук: Фаленты-Варшава, 2013. 208.-211.с.
2. Mūsdienīga slaucamo govju ferma: tehnoloģija, tehnika, apkalpošana./ J.Priekuļa red. Jelgava: LLU, 2012, 240 lpp. (InLatvian).
3. Priekulis J., Mangalis M. Govju mehāniskie virzītāji. //agro tops, 2013.g. septembris, 48-50. lpp. (InLatvian).