RESEARCH IN ROTARY PARLOUR OPERATION

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Abstract. The article summaries the results of rotary type milking parlour operation on five different farms. It has been stated that the milking equipment efficiency depends on the constructive solution of the milking equipment and the work of the milkers. For the *herringbone Systems-20* milking equipment the technological productivity of work is in the frame from 83 to 100 cows·h^{-1}, *herringbone Systems-32* – 133 cows·h^{-1}, but *Side-by-Side Systems P-36* – 144 cows·h^{-1}. In most cases the milking equipment operation costs are from 150 to 165 LVL per cow per year. These costs can be reduced if the size of the herd is optimized. The desirable milking equipment loading coefficient is 0.7 – 0.8.

Key words: milking, rotary type parlour, productivity of work, economical efficiency.

Introduction

In recent years in Latvia up-dating of milk production has been renewed for this reason building new and reconstructing old milk farms. Therefore, the sizes of the herds on the farms increase as well as cow handling and milk production technology solutions improve.

One of the today's trends is usage of rotary type milking parlours. Compared to other stand type equipment rotary parlours have higher productivity and therefore their application reduces the consumption of work. But such milking equipment is more complicated and expensive, besides, for its assembling more space is needed. But it, in turn, is related to increased capital investments that are necessary for purchasing and assembling of the equipment. Therefore, as our previous economic research shows [1], the rotary type parlour is economically efficient at comparatively large herds with not less than 200 – 300 cows.

At present there are eight rotary type parlours operating in Latvia that differ in the number of the milking places, location of cows during milking, organization of the milkers' work and other parameters. Therefore, it is possible to compare them in order to evaluate their economical efficiency in operation conditions. At present there has not such research been performed in Latvia and also it is scarcely described in special literature.

Materials and methods

We selected five farms for the research where rotary milking parlours are used. These farms differ in the number of milk cows, the milking equipment used and organization of the milker's work (Table 1).

As it can be seen in the table, on three of these farms the milking equipment *Herringbone Systems-20* is used, but on the farms the number of cows is different. At SIA "Kaķenieki" the milking equipment *Herringborne Systems-3,* is used but on the farm "Jāņlejas" – the equipment *Side-by-Side Systems P-36*. The peculiarity of this equipment is that the cows during milking are located parallel with their heads in the direction of the rotation center but the milker's work place is outside of the rotary parlour rotating ring.

Every farm uses a different solution of organization of the milker's work.

- At SIA "Daugava" the cows are milked by one milker three times a day. It is the only farm where automatic removal of clusters is not used but they are removed by the milker
- On the farm "Rudeņi" the cows are milked by twp people: one milker and an assistant. The milker cleans the cow's udder, attaches the teat cups (the clusters are removed automatically), takes prophylactic measures for ill cows (injects medicine etc.). In turn, the assistant disinfects the udders and teat cups, and rinses separate milking equipment if it is necessary, for instance, if the teat cups have been dropped. The specificity of this farm is that unlike on other farms the cows are milked two times per day.
- On the farm "Kalna Dambrāni" the cows are milked by one milker. The cluster is removed automatically. But the milker follows the procedure of milking. If it is stated that the milk yield of a cow has decreased the teat cups are attached repeatedly.

- At SIA "Kaķenieki" one milker is working performing all the necessary operations. But at the end of milking the udder quarters are not disinfected.

On the farm "Jāņlejas" rotary parlour with the cow location *Side-by-Side* is used. It promotes movement of the animals to and off the rotary platform. Three people participate in milking: two milkers and an assistant. One milker prepares the cows (cleans the udder and does fore milking) but the other attaches the milking clusters. In turn, the assistant disinfects the udders of the milked cows (after milking) and does other necessary work.

Table 1

Characteristics of the milking equipment on the farms under research

Indices	**Name of the farm**				
	SIA "Daugava"	Z.s. "Rudeņi"	Z.s "Kalna Dambrāni"	SIA "Kaķenieki"	Z.s "Jāņlejas"
Milking equipment	**Rotary milking**				
	Herringbone Systems - 20	*Herringbone Systems - 20*	*Herringbone Systems - 20*	*Herringbone Systems - 32*	*Side-by-Side Systems P - 36*
Number of milking places	20	20	20	32	36
Number of milkers	1	2	1	1	3
Number of milk cows	250	240	500	400	360
Number of milking times per day	3	2	3	3	3
Year of introduction	2000	2008	2009	2010	2010

For comparison of the milking equipment several criteria were used [2]:

- milking equipment technological productivity of work – W_o, cows·h^{-1};
- specific capital investments – $K_{īp}$, LVL per cow;
- specific consumption of work – $D_{īp}$, man hours per cow per year;
- specific exploitation costs – $IE_{īp}$, LVL per cow per year;
- milking equipment loading coefficient – η.

To calculate these criteria the following formulae have been used:

$$W_o = \frac{Z_g \cdot n_{sl}}{T_{sl}},\ K_{īp} = \frac{K}{Z_g},\ D_{īp} = \frac{\sum t_{st}}{Z_g}, \qquad (1, 2, 3)$$

$$IE_{īp} = \frac{IP + IM + I_s}{Z_g},\ \eta = \frac{T_{sl}}{24 - T_{mazg}}, \qquad (4, 5)$$

where Z_g – size of the milk herd;
n_{sl} – milking times per day;
T_{sl} – average length of milking without considering preparation and finishing time, including also equipment washing time, hours per day;
K – investments necessary for purchasing, assembling and starting the milking equipment, LVL;
t_{st} – consumption of work of people included in the procedure of milking, man hours per year;
IP – constant milking equipment machine costs, LVL·year^{-1};
IM – variable milking equipment machine costs, LVL·year^{-1};

I_s – salary costs for people included in the procedure of milking, LVL·year^{-1};
T_{mazg} – average length of milking equipment washing, hours per day.

To calculate these criteria definite software was developed, but the necessary input data were obtained from timekeeping of the milking processes on the farms as well as from the enquiry data. To compare the calculated costs it was assumed that on all farms the salaries are equal on all farms – for the milkers 400 LVL per month and for the assistants – 350 LVL per month.

Research results

The information on the actual milking equipment productivity of work is summarized in Fig. 1.

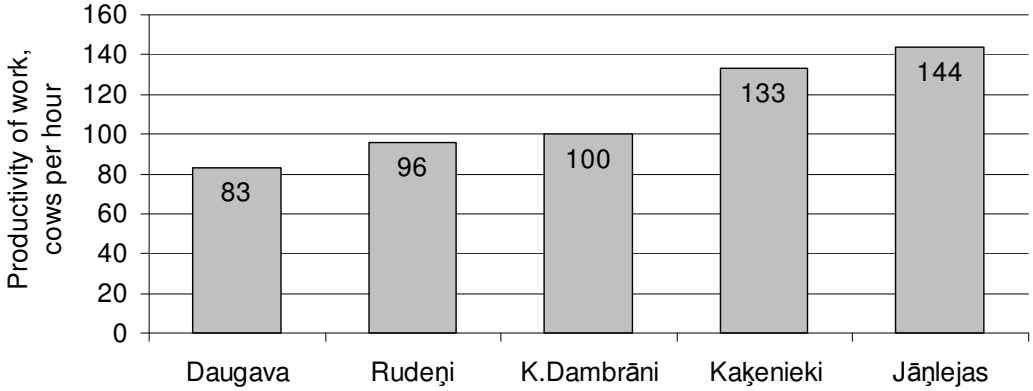

Fig. 1. **Milking equipment productivity of work on farms under research, cows per hour, according to timekeeping data**

On the farms "Daugava", "Rudeņi" and "Kalna Dambrāni" for milking the equipment *Herringborne Systems-20* is used. But the achieved productivity of work is different – in the frame from 83 to 100 cows·h^{-1}. This difference should be additionally researched as at SIA "Daugava", as well as on the farm "Kalna Dambrāni" the cows are milked by one milker. In turn, at SIA "Kaķenieki" and the farm "Jāņlejas" more productive and expensive rotary parlours are used, therefore, also the average work productivity is already 133 and 144 cows·h^{-1}.

The specific capital investments necessary for purchasing, assembling and starting the milking equipment as well as the specific consumption of work are shown in Fig. 2. From the figure a conclusion can be made that the specific capital investments introducing rotary parlour type milking equipment on separate farms have been from 364 to 758 LVL calculating per one cow. Besides, the numerical value of these capital investments is to a great extent dependent on the number of cows. The larger the herd, the less this index. So, for instance, on the farm "Kalna Dambrāni", where the milking equipment serves a herd of 500 cows the specific capital investments are approximately two times less than on the farm "Rudeņi", as the herd there is only 240 cows.

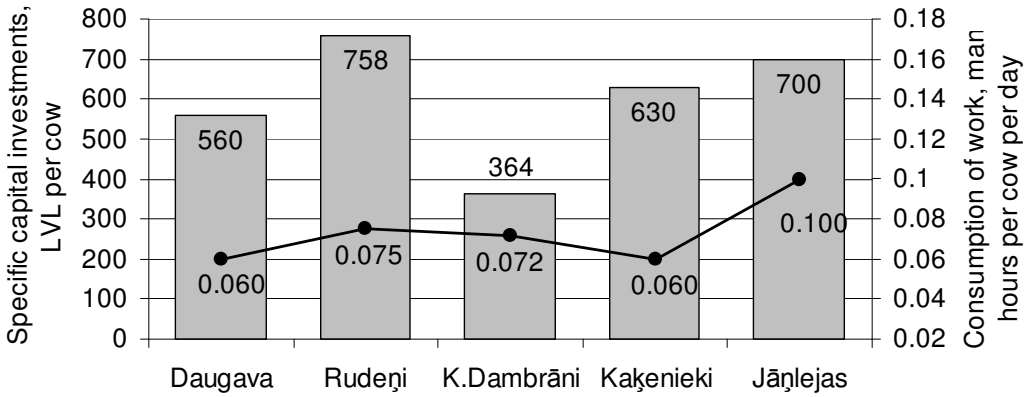

Fig. 2. **Comparison of milking versions according to specific capital investments and specific consumption of work**

In turn, the specific consumption of work is related to the number of people working during milking. If a milker and a driver, i.e., only two people participate in milking, then this index is 0.06 to

0.072 man hours per cow per day. If the cows are milked by two milkers and a driver, i.e., three people, it is 0.075, but if there are four people, the specific consumption of work reaches 0.1 man hours per cow per day. Such consumption of work was stated on the farm "Jāņlejas" where milking equipment with the milkers being outside the rotary parlour is used. As it was mentioned above, it is related to the peculiarities of the milking equipment. In this case cows can enter and leave the rotating platform faster, but it would make observation of the milking process more difficult and for it an additional person is needed

The specific exploitation costs of the milking equipment and its loading coefficients are summarised in Fig. 3.

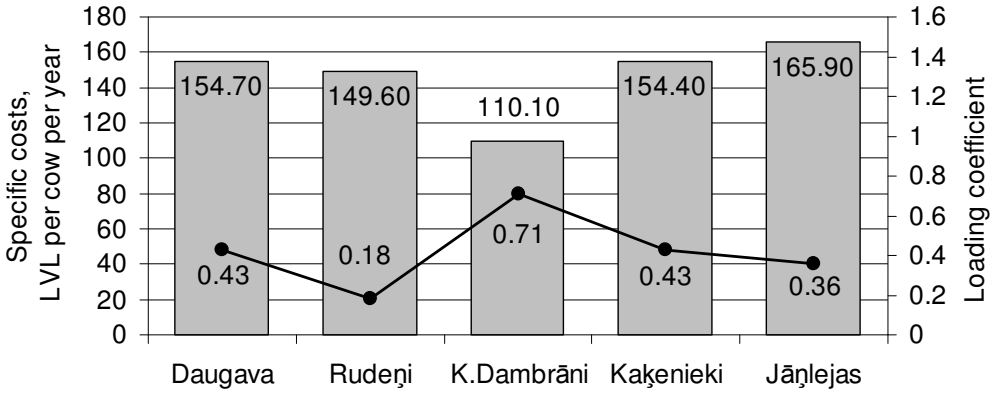

Fig. 3. **Milking equipment exploitation specific costs and loading**

It can be seen from the figure that the milking equipment exploitation specific costs are relatively similar on all farms – they are in the range from 150 to 166 LVL per cow per year. An exception is the farm "Kalna Dambrāni" where the specific costs are 110 LVL per cow per year. It is due to the reason that on this farm the herd of milk cows is considerably larger but in the result the milking equipment is better loaded. It is confirmed also by the milking equipment loading coefficient that is 0.71 for this farm.

According to the timekeeping data the average length of milking takes about 15 h per day. Considering that approximately 3 h every day are necessary for milking equipment maintenance (at three times milking) the maximal time of milking equipment application can be 20 h per day or the loading coefficient can reach 0.95. But in such case cows have to be milked also during nights. Therefore, the loading of the milking equipment on the farm "Kalna Dambrāni" can be considered as optimal and also other farms should strive towards such loading increasing their herds.

Conclusions

1. The rotary parlour productivity of work depends on the constructive solution of the equipment and the procedure of milking. On the farms under the research the productivity of work was 83 – 144 cows·h^{-1}.
2. If herringbone type rotary parlours are used, the milking equipment can be served by one, maximally two persons, but using the Side-by-Side parlour with the milker's work place outside the parlour, two or three milkers are needed for servicing the equipment.
3. The economic profitability of the milking equipment is influenced not only by exploitation costs but also by the number of cows and productivity of the equipment. The more loaded the equipment is, the lower the specific exploitation costs are. In the optimal case the milking equipment loading coefficient should be 0.7 – 0.8.

References

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