

## ECONOMIC PROFITABILITY OF MILK PRODUCTION

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**Abstract.** Three different kinds of technological versions of milk production have been compared: when cows are tied in warmed barns and milked in the milk line, when cows are kept in cold barns and milked in the milking parlour and when cows are handled loose in cold barns and milked in milking robots. The versions have been compared according to the obtained milk production cost applying a special mathematical model designed for this purpose. It has been stated that handling of cows in cold barns and milking in a separate milking parlour have turned out to be the most efficient milk production technologies. Nevertheless, it is possible to reduce the milk production cost also increasing the milk yield and the size of the herd. If, for instance, the milking robots VMS produced by the company „DeLaval” and corresponding to them milk production technologies are applied, then at the milk yield 10000 kg year<sup>-1</sup> the milk production cost is 0.16-0.17 Ls kg<sup>-1</sup>, but at the milk yield 8000 kg year<sup>-1</sup> it is 0.17-0.19 Ls kg<sup>-1</sup>.

**Key words:** production of milk, milk production cost, milking robots, milk yield, size of the herd.

### Introduction

Dairy farming is one of the leading branches of Latvian agriculture, but at the present moment it is influenced by deep economic crisis. In 2006 milk produced in Latvia comprised 25 % of the total final production value of the produced agricultural products, but in 2007 – 20 % [1]. In 2008 the purchasing price of milk has reduced 1.5-2.0 times and on many farms it does not cover the milk production cost any more. Therefore, this branch does not longer bring the desired income but causes serious loss.

Nevertheless, there are all the necessary prerequisites for the development of dairy farming in Latvia. There are favourable climatic conditions, the necessary material resources, accumulated experience in this kind of work and trained workers. It should also be considered that in animal breeding as well as in other branches of production operational technologies are gradually developing. If 30-40 years ago cows were kept in warm barns and milked in boxes using milk lines installed in the barns, then today mainly cold barns are being built and cows are milked in the milking area or even milking robots are used.

Application of the new technologies and up-dated machinery essentially facilitates the working conditions of the workers and reduces the number of people necessary for work in animal breeding. Still one of the most important criteria of production is the production cost of the obtained products as it can be influenced by different factors. Therefore, the aim of the present research was to compare different technologies of milk production and to find out the main prerequisites observation of which ensures cheap production of milk.

### Materials and methods

In order to state the economic efficiency of milk production three technological solutions were compared. In the first version cows are tied in warm barns and milked in the milk line with mobile milking machines. In the second version cows are handled loose in cold barns and milked in a separate milking parlour using the stand type milking equipment. In the third version cows are handled loose and milked in milking robots (Table 1).

In all versions basic feed was prepared and distributed as a mixture using a feed mixer distributor hitched to the tractor. This mixture included also a part of feed concentrate that was necessary for the cows, but the rest part was fed by means of small mechanisation (Versions 1 and 2) or in the robotised milking stand (Version 3). For removal of manure stationary equipment corresponding to every kind of animal handling was used.

For all three basic versions two different barn sizes (for 120 and 240 cows) as well as two different payment levels (400 un 800 Ls month<sup>-1</sup>) were chosen. Such a number of cows is adequate to the milking robot application possibilities as one robot VMS can serve 60 cows [2, 3]. So, for milking of 120 cows two such robots are needed, but for 240 cows – four robots. In turn, the salary of the

workers (400 Ls month<sup>-1</sup>) corresponds to the average payment for animal breeders on the training and research farm „Vecauce” of the Latvia University of Agriculture and 800 Ls month<sup>-1</sup> – to the approximate average animal breeder salary in the countries of Western Europe.

Table 1

### Compared technological versions

| Indices                             | Version 1                           | Version 2   | Version 3   |
|-------------------------------------|-------------------------------------|---|---|
| Number of cows                      | 120 or 240                          | 120 or 240  | 120 or 240  |
| Type of barn                        | warm                                | cold  |   |
| Milking of cows                     | In milk line installed in the barn  | In a parlour with the herring-bone type stand equipment | With milking robots produced by the company „DeLaval” |
| Distribution of basic feed          | Using mobile feed mixer distributor |   |   |
| Feeding of concentrated feed        | Using small mechanisation           |   | In the robot stand                                    |
| Removal of manure                   | With bar type conveyors             | With delta type conveyors                               |   |
| Necessary number of people          | 8.0                                 | 6.5   | 4.0   |
| Average salary of workers, Ls/month | 400 or 800                          | 400 or 800  | 400 or 800  |

For calculations a special computer program was designed [4] where data on the costs for purchasing and assembling of the necessary technological equipment, life time of the machinery, the number of people working on the farm and their salaries, consumption and costs of fuel and electroenergy, the number of cows on the farm, milk yield, obtained additional income (from manure, calves and defected cows), forage costs at different levels of milk yield as well as other data necessary for the calculation were inserted. By means of the computer program all the most important operational cost posts calculating per one cow per year as well as the production cost of the obtained milk were calculated.

### Results and discussion

The changes of the milk production cost depending on the milk yield and the corresponding technological version are shown in Figures 1 and 2.

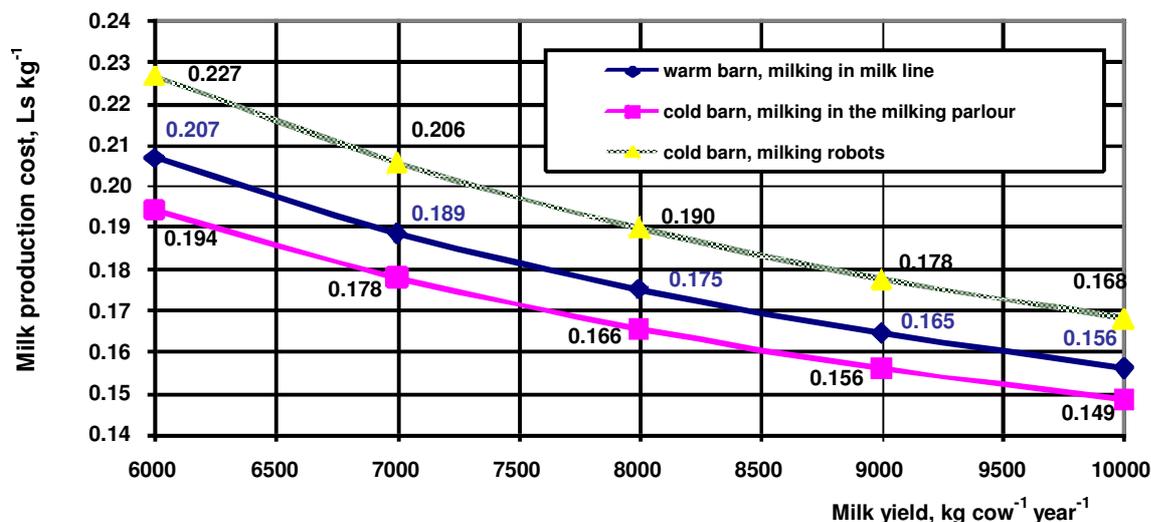


Fig. 1. Changes of the milk production cost depending on the milk yield and the used technological version if the average salary of the workers is 400 Ls month<sup>-1</sup>

Figure 1 shows the results of calculations when the average salary of the workers is 400 Ls month<sup>-1</sup>. It can be seen that the production cost of milk depends on the technological version as well as on the milk yield. It is the lowest if the cows are handled in cold barns and milked in the milking parlour using the stand type equipment (Version 2). In turn, the production cost is the highest (approximately 15 % higher) in the case if the cows are milked by robots (Version 3). Besides, if the milk yield increases from 6000 kg to 10000 kg, the milk production cost decreases by approximately 30-35 % for all versions.

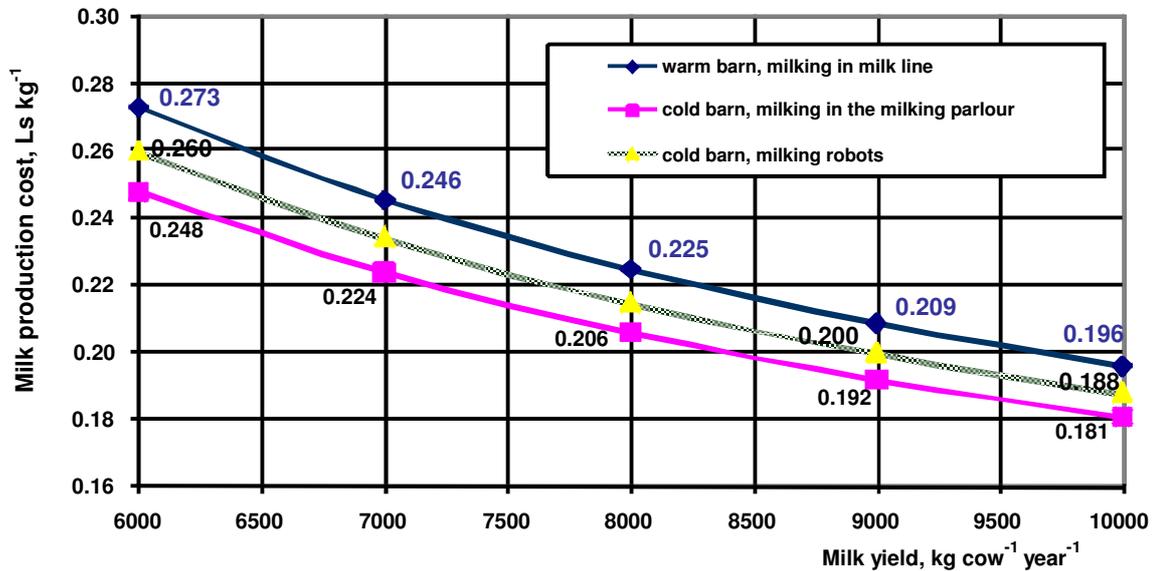


Fig. 2. Changes of the milk production cost depending on the milk yield and the used technological version if the average salary of the workers is 800 Ls month<sup>-1</sup>

If the average salary for the workers increases up to 800 Ls per month as it is in the developed Western European countries the milk production cost increases by 0.03-0.07 Ls kg<sup>-1</sup> (Figure 2). Besides, the highest rise in production cost can be observed if the cows are kept in warm barns and milked in boxes using the milk line and mobile milking machines (Version 1). In this case the production cost of the obtained milk becomes even higher than milking with robots. In turn, the lowest milk production cost will be obtained if the cows are handled loose and milked in the milking parlour (Version 2). Therefore, such technology is the most profitable at the salaries for the workers 400 Ls as well as at 800 Ls per month.

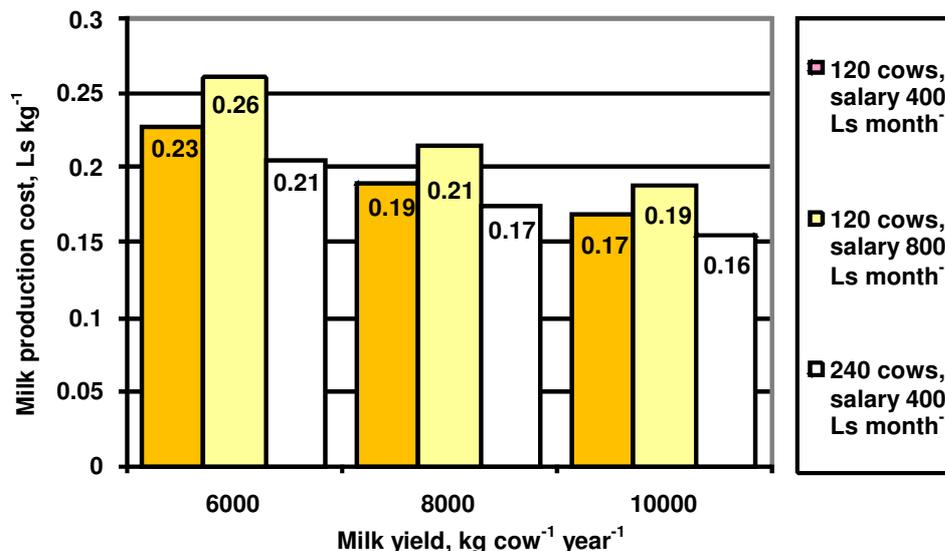


Fig. 3. Changes of the milk production cost using milking robots with altered milk yield, number of cows and average salary for the workers

It can be seen in Figure 3 that the milk production cost is influenced by the number of cows in the barn. If, for instance, in the case of robotised technology the size of the herd increases from 120 to 240 cows, the milk production cost decreases by 0.1-0.2 Ls kg<sup>-1</sup>. It can be explained by more intensive loading of the animal feed distribution machinery as well as by more rational usage of the working hours of the workers.

It is possible to milk such a herd also with one milking robot *Mlone* [5] of the company „WestfaliaSurge” replacing the four company „DeLaval” robots VMS included in the calculation. Considering that the robot *Mlone* has also lower price (than the four VMS robots) it can be prognosticated that this robot is even more profitable for a herd of 250 cows and it will ensure the production cost of the obtained milk approximately on the same level as milking the cows in the milking parlour.

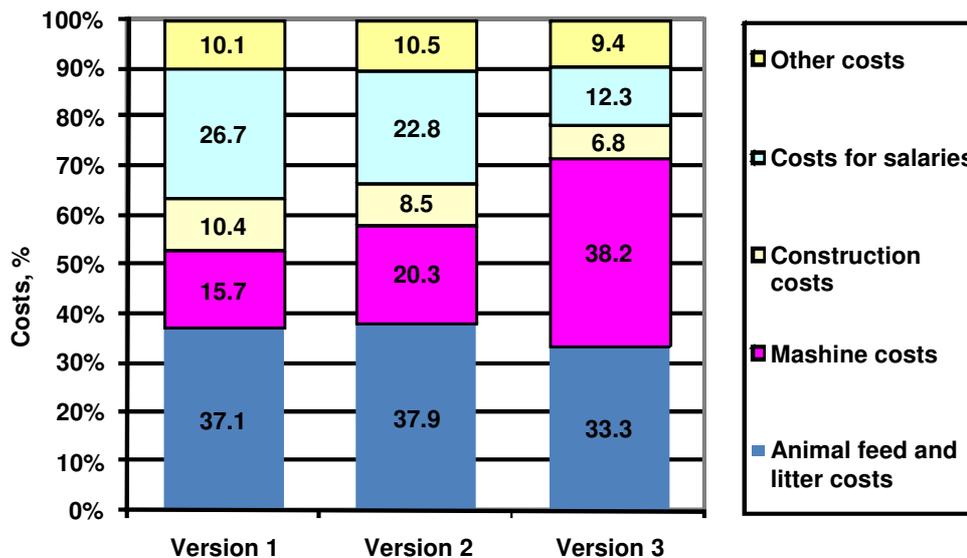


Fig. 4. Structure of the milk production cost using different technological versions if the average milk yield is 6000 kg year<sup>-1</sup> and the average salary for the workers is 400 Ls per month

Figure 4 shows the structure of the milk production cost using all three technological versions. It can be concluded that introducing milking in robots the part of machine costs considerably increases approaching the level of 40 %. Nevertheless, reduction of these costs in practice has a little possibility as it is determined by the chosen technology.

Also the part of animal feed and litter costs is considerably large (33-38 %). Therefore, it is necessary to use the possibly cheapest animal feed, for instance, self-made silage and forage grain. But this feed should be also qualitative in order to ensure high milk yield. Also rational consumption of mixed feed concentrate should be ensured in compliance with the requirements of the precision technology.

If the milking robots are applied, the part of the salaries for the workers reduces up to approximately 12 %. Therefore, the costs of this technology are less dependent on the possible increase of the salaries in the future.

## Conclusions

1. Economically the most efficient technological version of milk production is handling of cows in cold barns and milking in a separate milking parlour using the stand type equipment.
2. In order to reach minimal milk production cost it is necessary to achieve high milk yield, the number of the herd should be optimal and adjusted to the chosen milking equipment as well as the existing labour force on the farm should be used efficiently. If, for instance, the average milk yield increases by 1000 kg year<sup>-1</sup>, the milk production cost decreases by 0.005-0.02 Ls kg<sup>-1</sup>.

3. Using the milking robots VMS of the company „DeLaval” and the milk production technology adjusted to them, the milk production cost at the milk yield 1000 kg year<sup>-1</sup> is 0.16-0.17 Ls kg<sup>-1</sup>, but at the milk yield 8000 kg year<sup>-1</sup> it is 0.17-0.19 Ls kg<sup>-1</sup>.

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