

Trend of cow herd size in Baltic states

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Abstract. The article analyses trend of cow herd size from 2000 to 2019 in four Baltic states: Estonia, Latvia, Lithuania and Poland. It has been stated that during this period of time the average size of cow herds has increased 3–4 times, except in Estonia, where it has increased 8 times. Nevertheless, the number of cows in the herds is different in individual countries. In the herds with up to 5 cows in Estonia there are about 2% of cows, but in the other Baltic states it is 10–18% of the total number of cows. In turn, in the herds with 50 or more cows, what corresponds to implementation of modern milk production technologies and machinery, in Latvia and Lithuania there are about 50% of cows, in Poland 30%, but in Estonia 90% of the total number of cows in the country. It has influenced the specific labour intensity of the people working in milk production. In Estonia, this indicator in 2019 was about 100 man-h per cow per year, but in the other Baltic states it was 300–350 man-h calculating per cow per year. Still, with robotization and automation of all basic work operations the specific labour intensity in milk production can be decreased to 30–50 man-h calculating per cow per year. Therefore, there are still great development possibilities in all Baltic countries.

Key words: cow, dairy farm, modernization, labour intensity, herd size.

INTRODUCTION

Milk production is one of the main branches of agriculture in the Baltic states: Estonia, Latvia, Lithuania and Poland. For instance, in 2019 the income from this branch was 20% of the total income from agriculture (Latvia Agricultural Yearly Reports). Therefore, in all Baltic states the milk production technologies and mechanization are continuously modernised. Nevertheless, our previous research shows that it is profitable to introduce modern technologies and machinery only if the number of milk cows in the farm is large enough (Priekulis, 2000; Priekulis et al., 2000). The size of the dairy cow herd,

combined with the increase in milk yield of cows, influences the efficiency of modern dairy production technologies, especially milking (Gaworski et al., 2013). For this purpose, new farms are built and the existing farms are reconstructed in the Baltic states in order to ensure the measures of environment protection. In the result the milk yields increase and the labour intensity of people working in milk production decreases. Labour intensity, which is one of the key indicators of the assessment of production processes on a farm, is defined (Næss & Bøe, 2011) as labour input (expressed in man-hours) related to the reference unit (e.g. one cow) in the considered period of time (e.g. one year).

At present, complex research results are not available that could reveal the present situation in the branch of milk production in relation to the changes of the cow herd size from 2000 up to now. The aim of the study was to analyse the changes in the dairy cow herd size in the four Baltic countries over the past two decades in order to assess the required labour demand in milk production.

MATERIALS AND METHODS

The research covers the period of time from 2000 to 2019. A decade passed from regaining independence in 1990 to the beginning of the survey (2000), and farms and other production enterprises developed and stabilized in all the Baltic countries. For the research, statistical data of Estonia, Latvia, Lithuania and Poland were used (available at: www.epj.ee; www.zm.gov.lv; www.scb.gov.lv; www.vic.lt; www.stat.gov.pl). Methodologies developed in Latvia for the evaluation of cow herd modernization were used, depending on the type of animal handling and labour intensity of people working in milk production (Priekulis & Laurs, 2020). The main evaluation criteria were as follows:

- Average number of cows in one farm;
- Proportion of cows handled loose;
- Proportion of cows in the relation to the size of the herd;
- Specific labour intensity necessary for production of milk.

The average number of cows in a farm was calculated according to the following formula:

$$Z_{g,vid} = \frac{\sum Z_g}{\sum N_s} \quad (1)$$

where: $Z_{g,vid}$ – average number of dairy cows in one farm in the definite year and country; $\sum Z_g$ – total number of dairy cows in the definite country and year; $\sum N_s$ – total number of dairy farms in the definite country and year.

The proportion of cows handled loose was calculated according to the methodology developed by Laurs et al. (2016) and Priekulis & Āboltiņš (2015). Analyzes presented in the above-mentioned studies show that changing the handling of cows from tied to loose is done, if the size of the herd is within 50 to 100 cows, 75 cows in average. So, the proportion of cows that are handled loose is:

$$\theta = 100 - n_{1-75} \quad (2)$$

where: θ – proportion of cows in the definite country and year handled loose, %; n_{1-75} – proportion of cows in the definite country and year in herds from 1 to 75 cows, %.

In order to evaluate the possibilities of technological and technical modernization of milk production, the cow herds were divided in four groups: up to 5 cows, from 6 to 49 cows, from 50 to 200 cows and more than 200 cows. As our previous research (Priekulis & Laurs, 2020) shows, in dairy farms with up to 5 cows all work is done by one family. The cows are tied. Milking is mechanized, and water is supplied by pipelines and distributed between animals using simple and cheap technical solutions - drinkers. The obtained products are used for the family needs or sold in the local market. If the size of the herd reaches 6 to 49 cows, all main work operations are mechanized, and the obtained milk is delivered to special processing enterprises. Also, in farms with 50 to 200 cows the work is most often carried out by one family, only in rare cases working force is preferred, but automated and robotised machinery is introduced. If there are more than 200 cows, they are handled loose, modern high productive machinery is applied and labour force requirement is much lower.

Labour intensity of people working in dairy production was calculated as average weighted value using the following formula:

$$D_c = \frac{\sum_{i=1}^n D_{ci} \cdot \lambda_{\%i}}{100} \quad (3)$$

where: D_c – average weighted labour intensity of people working in milk production in the definite country and year, man-h cow⁻¹ year⁻¹; D_{ci} – average labour intensity of people working in the i -th herd size group, man-h cow⁻¹ year⁻¹; $\lambda_{\%i}$ – proportion of cows in the definite country and year in the i -th herd size group (available at: www.epj.ee; www.zm.gov.lv; www.scb.gov.lv; www.vic.lt; www.stat.gov.pl); n – total number of herd groups (in this case four size groups).

A special software was developed for the necessary calculations.

RESULTS AND DISCUSSION

The changes of the cow herd sizes in the countries included in the research are shown in Fig. 1. A conclusion can be made that in all countries there is concentration of animals forming larger herds. In Latvia, Lithuania and Poland this increase from 2000 to 2019 has been approximately 3–4 times, reaching in average 10 milk cows in one herd. In turn, in Estonia the increase of the size of herds is more than eight times, reaching 60 cows in one farm. It can be explained by the existing agricultural policy in Estonia - to develop mainly the large farms (Luik, 2009; Luik-Lindsaar al., 2018). Besides, this policy has been implemented already since regaining independency in the Baltic states in 1990, and it caused liquidation of many small farms. But at the same time the preconditions were created for increase of cow herds and implementation of modern and highly profitable machinery for animal breeding.

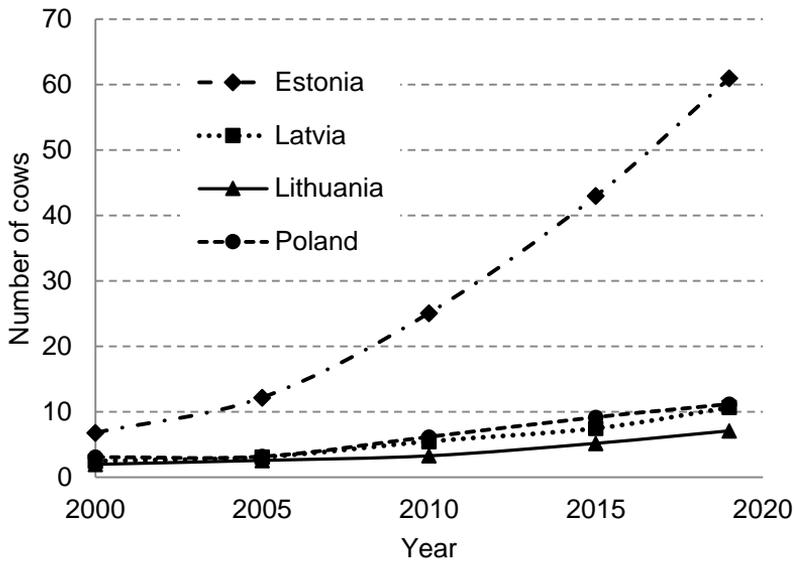


Figure 1. Changes in the average size of a herd of dairy cows on farms in the Baltic countries in 2000–2019.

Proportion of milk cows according to the size of the herd is shown in Fig. 2.

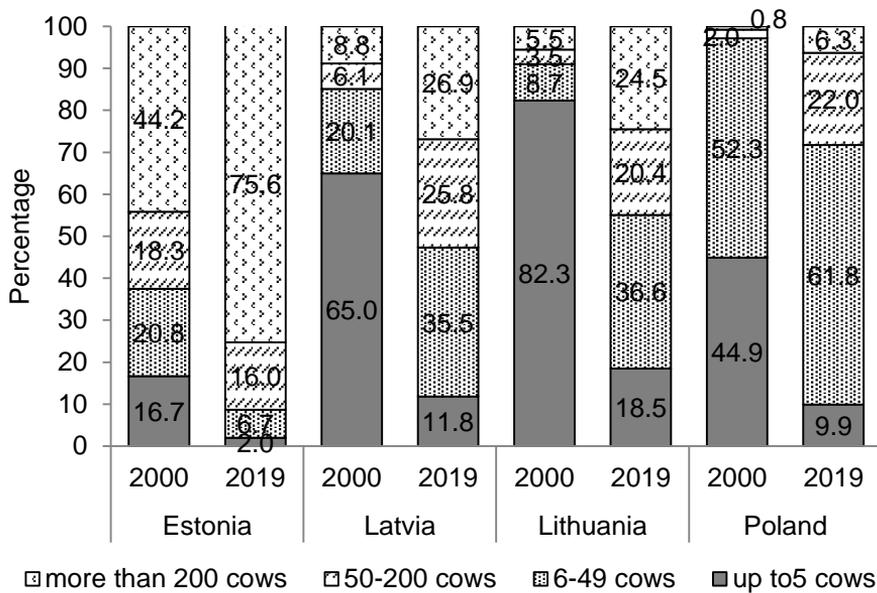


Figure 2. Proportion of milk cows according to the size of the herd in the Baltic countries in 2000 and 2019.

In 2000 the proportion of milk cows according to the size of the herd was different in the Baltic states (Fig. 2). The small herds with up to 5 cows were most common in Lithuania and Latvia. In turn, the large herds with 200 and more milk cows were most widespread in Estonia (44% of the total number of cows). Still, in 2019 the proportion of animals in small herds (up to 5 cows) had decreased 5–8 times. On farms of 200 and more cows in Estonia, there were 75% of the total cow population, but in Latvia and Lithuania - approximately one fourth of the total number of cows. Poland was an exception, because in 2019 a group of 62% of cows were kept in herds of 6 to 49 heads. It can be explained by the political situation in this country, as in Poland small farms existed already before 1990 and their enlargement is unlikely.

Another essential indicator is the number of cows in the herds with more than 50 animals, as it provides possibilities for implementation of modern milk production technologies and machinery. As the data summarised in Fig. 2 show, in Lithuania and Latvia there are already approximately 50% of cows in such herds, in Poland 30%, but in Estonia even 90% of the total number of cows.

Information on the proportion of cows handled loose is given in Fig. 3.

Number of cows handled loose is different in the countries (Fig. 3). In Estonia in 2019 this number is about 85% of cows, but in Poland only 20%. Loose handling is important in relation to animal welfare, as well as to the possibilities of mechanization and automation of animal breeding operations (Laurs et al., 2016; Luik-Lindsaar et al., 2019). Besides, it is also essentially related to the labour intensity of the people working in milk production farms (Fig. 4).

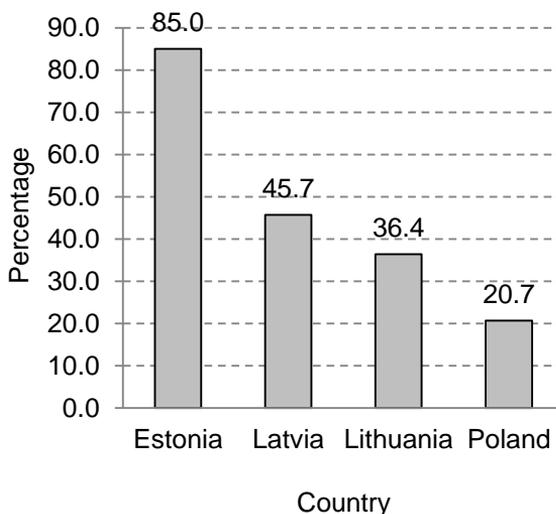


Figure 3. Proportion of cows handled loose in 2019.

In the period of time from 2000 to 2019 the specific labour intensity of the people working in dairy production farms has decreased approximately 2.5 times (Fig. 4). It is due to the increase of the herds and modernization of the cow farms, as in larger farms it is possible to introduce modern technologies and automated machinery. Also, this indicator is the best in Estonia, where the specific labour intensity approaches 100 man-hours per cow per year.

Still, today's experience shows that with robotization and automation of all basic work operations the specific labour intensity in milk production can decrease to 30–50 man-hours calculating per cow per year (Sonck, 1996; Artmann & Bohlsen, 2000). Therefore, in all Baltic states there are still development possibilities.



Figure 4. Specific labour intensity of people working in dairy production farms, in man-h cow⁻¹ year⁻¹.

The herd size and the level of milk production are the main factors contributing to the full use of the technical and technological potential of modern on-farm milking equipment (Rotz et al., 2003). The concentration of a herd of dairy cows translates into the production potential of the farm, which, together with the technical potential, determines the production development in the current and future time (Gaworski & Leola, 2014). The size of the dairy cow herd determines the selection of milking systems, their development and efficiency of use (Chiumenti et al., 2020), as shown by examples of comparisons taking into account the regional specificity of dairy production (Gaworski et al., 2013; Gaworski & Priekulis, 2014). The importance of the research on the size of the dairy herd was confirmed by Gargiulo et al. (2018), who indicated that farmers with dairy farms with a larger herd of dairy cattle are inclined to implement more sophisticated dairy technologies. Detailed research also highlights the importance of the production region and herd size in assessing the performance parameters of dairy herds (Oleggini et al., 2001). It is also important to link the size of a dairy herd with its welfare (Robbins et al., 2016; Gieseke et al., 2018) and providing animals with appropriate health care (Põldaru & Luik-Lindsaar, 2020) and longevity (Leso et al., 2019), which translates into an assessment of the effectiveness of dairy production. Thus, the examples of the undertaken research justify the need for further development of the issue of dairy herd concentration and the resulting effects, including those related to the labour intensity of handling the herd.

CONCLUSIONS

In all Baltic states there is intensive concentration of cow herds allowing for the possibility to implement modern milk farming technologies and machinery. Since 2000 to 2019 the average size of cow herds has increased 3–4 times, except in Estonia, where it has increased eight times. In all countries there are also small cow farms with up to 5 animals. In Estonia there are about 2% of the total number of cows in such farms, but in the other Baltic states 10–18% of the total number of cows.

Modern milk production technologies and machinery can be introduced mainly in the herds with 50 and more cows. In Latvia and Lithuania such herds are approximately 50%, in Poland 30%, but in Estonia - even 90% of the total number of cows.

The increase in the cow herd sizes allows for modernization of the dairy cow farms, transfer to loose handling of cows, as well as implementation of robotization and automation of technological processes. In Estonia where the highest cow herd concentration has been achieved, 85% of the total number of cows are handled loose, but in Poland where there are the smallest herds, this indicator is about 21% of the total number of cows. Besides, in Estonia the specific labour intensity of the people working in milk farming in 2019 only lightly exceeded 100 man-hours per cow per year. In the other Baltic states it was 300–350 man-hours per cow per year.

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