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Original Article

The influence of productivity indicators on the culling of dairy cows in the sharply continental climate of Kazakhstan

O impacto dos indicadores de produtividade no abate de vacas leiteiras no clima acentuadamente continental do Cazaquistão

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Abstract

This article presents the results of the culling of cows of the Simmental and Holstein breeds in the Republic of Kazakhstan. The purpose of the research was to study the actual number of culled cows of dairy productivity in the farms of the Republic of Kazakhstan to determine its norm. The object of research were cows of Simmental (18,462 heads) and Holstein (17,862 heads) breeds in various regions of the republic. The research was carried out according to generally accepted zootechnical methods using statistical data processing using RStudio. The results of the studies showed that the percentage of culling increases in cows of the Simmental and Holstein breeds and amounts to 19.7 and 22.9%, respectively. The analysis of the retirement of full-aged cows of the Simmental breed showed that the main causes are hoof diseases (up to 26%), low reproductive function (up to 21%), low productivity (up to 18%). Holstein cows had an increase in disposals in all categories except for disposals for various reasons, for problems with reproduction, the disposal is up to 21%. The determination of the relationship between productivity and retirement in the Simmental breed cows showed that with age and increased lactation, the proportion of retired cows also increases, in the Holstein breed, with increased productivity, the percentage of culled animals also increases.

Keywords: culling, reproduction, milk productivity, hoof diseases, udder diseases, lack of exterior, longevity.

Resumo

Este artigo apresenta os resultados do abate de vacas Simental e Holstein na República do Cazaquistão. O objetivo do estudo foi estudar o número real de vacas abatidas na direção da produtividade leiteira nas fazendas da República do Cazaquistão para determinar sua norma. O estudo incluiu vacas Simental (18.462 cabeças) e Holstein (17.862 cabeças) em diferentes regiões da República. A pesquisa foi conduzida de acordo com métodos zootécnicos geralmente aceitos, adotando o processamento estatístico de dados, usando o RStudio. Os resultados da pesquisa mostraram que as vacas Simental e Holstein aumentaram a taxa de abate para 19,7% e 22,9%, respectivamente. A análise da alienação de vacas Simental de meia-idade mostrou que as principais causas são doenças dos cascos (até 26%), baixa função reprodutiva (até 21%) e baixa produtividade (até 18%). As vacas Holstein tiveram um aumento na alienação em todas as categorias, exceto a alienação por várias razões; devido a problemas reprodutivos, a alienação é de até 21%. A determinação da relação entre a produtividade e a alienação em vacas Simental mostrou que a proporção de vacas eliminadas aumenta com a idade e o aumento da lactação, enquanto a porcentagem de animais eliminados aumenta com a produtividade na raça Holstein.

Palavras-chave: eliminação, reprodução, produção de leite, doenças dos cascos, doenças do úbere, falta de exterior, longevidade.

1. Introduction

Ensuring the ability of animals to reproduce, i.e. the production of germ cells, the main indicator of the determining level of development is the indicator of the physiological maturity of the animal.

To reduce the indicators of culling dairy animals from the main herd, at the time of insemination, heifers should be physiologically developed and well prepared for the reproduction process. The main indicators determining the period of insemination of animals are their age, live weight indicators, fatness of animals and the overall development of their organism. When heifers reach 65-70% of the live weight of an adult animal of the corresponding breed with

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the completion of the development of the whole organism, in which the animal acquires exterior and constitutional features, their economic maturity is formed.

Culling cows in economic conditions that do not meet strict requirements for dairy cattle with high productivity, capable of showing their genetic potential and leads to a reduction in the productive longevity of cows.

At the moment, most dairy cows are retired during the most productive period or even earlier. The reasons for retirement are low productivity after 1 and 2 lactation, problems with limbs, impaired reproductive functions, as well as pathological calving and various injuries (Ryaposova et al., 2012).

Long-term use of dairy cows allows you to reduce production costs, increase cow productivity, cull low-yielding animals, conduct selection to increase milk productivity.

Early culling of cows reduces the reliability of the assessment of productive, breeding qualities, since they leave a small number of descendants. Cows that live for a long time have a strong constitution, are resistant to diseases, good udder development and reproductive qualities (Volkova, 2001).

The criterion for breeding and increasing milk productivity is the selection of young animals from such mothers (Gordeeva, 2011; Shendakov et al., 2013). Therefore, the longevity of cows is of great importance when using improver bulls for signs of dairy productivity.

Evaluation of breeding qualities of breeding bulls by genetic potential makes it possible to select improvers for use in the breeding process (Alifanov and Alifanov, 2010; Batanov et al., 2011; Gerasimov et al., 2011). It is also important to identify bulls that degrade the breed, in order to minimize the manifestation of the genotype on descendants.

Premature culling and, as a consequence, a reduction in the period of economic use of animals cause financial losses to the dairy industry and are urgent problems of animal welfare (Medvedev et al., 2014). Scientists R.H. Miller, M.T. Kuhn, H.D. Norman, J.R. Wright (Miller et al., 2008) note that in recent years there has been a tendency to mortality in dairy cows, and high rates of involuntary factors leading to mortality cause concern on dairy farms. According to research by C.S. Mc Connel, J.E. Lombard, B.A. Wagner, F.B. Garry (McConnel et al., 2008) additional factors significantly influencing culling decisions are the cost of milk, the form of herd management, the reproductive policy carried out on the farm, the type of premises, the level of production, the size of the farm and the breed of cattle.

The duration of economic use is the period from birth to culling (Dubuc and Denis-Robichaud, 2017). Currently, the average life expectancy of dairy cows in modern commercial farms ranges from 4.5 to 6 years, which is much lower than their biological capacity of about 20 years (De Vries, 2017). However, in the last 10 years, no matter how much scientists have tried to improve the technologies of keeping, reproduction, feeding, as well as genetically increase the economic use of cows, they have not advanced far enough. All this makes you think that this indicator is influenced not only by the above factors, but by the well-being and ethical use of cows. In this regard, scientific work in this area is so strongly developed in the dairy countries of Europe. At the same time, De Vries A. indicates that the reduction in the use of cows may be due to economic considerations, but it is not always economically beneficial to the farmer (De Vries, 2017).

The life span of a dairy cow is determined by culling, which is the departure of cows from the herd due to sale, slaughter, disposal or death. In cases of low culling rates, the life expectancy of cows is usually high. Cow culling is the result of a combination of various factors, such as cow health, milk yield and reproductive efficiency, but also depends on market conditions. Culling is a major cost for dairy farms, but is also an important part of herd productivity management. According to the scientific research of A.C. Boulton, J. Rushton, D.C. Wathes (Boulton et al., 2017), the costs of raising heifers were reimbursed during the first two lactations, i.e. about 3.6 years, whereas for profitability dairy cows must produce at least four lactations. Since mature cows have higher milk yields compared to young cows (Rushen and De Passillé, 2013), a higher life expectancy is associated with a higher proportion of highly productive cows in the herd, therefore lower culling rates are usually more economically advantageous (De Vries and Marcondes, 2020).

Studies conducted by Jan Olechnowicz (Olechnowicz and Jaśkowski, 2011) indicate culling of cows with a bias for laminitis in highly productive cows. From the data presented by the authors, it follows that the total culling of cows per year is 20-35%, and lameness, in turn, reduces productivity by 40%, treatment costs are increased by 34%, and the fertility of cows is reduced by 26%. Thus, chromate is also a frequent cause of cow retirement.

N.M. Nor (Nor et al., 2013) in their studies conducted in the Netherlands, in the period from 2007 to 2010, on dairy herds, write that the number of repair heifers in the herd directly depends on the percentage of culling cows of the herd. The results showed that the average cull rate was 25.4% and ranged from 23% (2007) to 28%.

Studies by Pinedo P.J., De Vries A., Webb D.W. (Pinedo et al., 2010) indicate that physiological death is a major part of the cull rate – 20.6%, followed by low reproductive function – 17.7%, injuries – 14.3%, and low productivity and mastitis accounted for 12.1%.

The reasons for culling have changed over the past decades, shifting more towards disease-related causes (Olechnowicz and Jaśkowski, 2011). Due to the inclusion of various parameters in the culling models, studies presented by a number of scientists have revealed variable optimal culling rates for dairy herds in the range of 25-28% at the lowest possible level of 20% (De Vries, 2017). However, a high level of forced culling is not economically feasible for farms (Nor et al., 2013).

Studies by B. Clark, G.B. Stewart, L.A. Panzone, I. Kyriazakis, L.J. Frewer (Clark et al., 2016), E. Hare, H.D. Norman, J.R. Wright (Hare et al., 2006), A.N. Hristov, T. Ott, J. Tricarico, A. Rotz, G. Waghorn, A. Adesogan, J. Dijkstra, F. Montes, J. Oh, E. Kebreab, S.J. Oosting, P.J. Gerber, B. Henderson, H.P.S. Makkar, J.L. Firkins (Hristov et al., 2013) indicate that the rates of culling of dairy herds have not increased over the past decades, but the duration of economic use of cows is constantly decreasing worldwide,

which entails economic consequences and environmental impact, resulting in deterioration of the health and well-being of cows and the strengthening of social problems of mankind.

Although the duration of economic use of cows contributes to the sustainability of dairy production, there are currently very few studies determining the economically optimal productive duration of economic use of cows. There are also big differences in what dairy farmers consider the optimal or target life expectancy, both in terms of how the duration of economic use is expressed, and in terms of what they consider possible to achieve (Bergeå et al., 2016).

Most studies to date have focused on the causes and risk factors of culling and the duration of economic use of cows. The identified risk factors mainly relate to the indicators of the animal itself (for example, cow productivity indicators, diseases or reproductive indicators), as well as to farm conditions, feeding and management factors (Chiumia et al., 2012; Haine et al., 2017; Rilanto et al., 2020).

From the studies of M.L. Van Pelt, G. De Jong, R.F. Veerkamp (van Pelt et al., 2016), it follows that the genetic trend of productive use of cows is increasing, but simultaneously with the improvement of knowledge and improvements in genetics, the indicator of the duration of economic use of cows shows a downward trend.

These studies were continued in the studies of F. Adler, R. Christley, A. Campe (Adler et al., 2019), J. Lai, N.J.O. Widmar, C.A. Wolf (Lai et al., 2019), C. Ritter, J. Jansen, S. Roche, D.F. Kelton, C.L. Adams, K. Orsel, R.J. Erskine, G. Benedictus, T.J.G.M. Lam, H.W. Barkema (Ritter et al., 2017). Scientists note that the tendency to reduce the period of economic use of cows may occur due to the low priority of sustainable breeding programs, insufficient awareness of the community of farmers about limiting factors or due to factors arising from the desire or ability of farmers to implement the necessary changes. Although substitution policy has an important impact on the economic performance of a dairy herd, culling decisions often involve subjectivity, intuition, and individual thresholds of the decision maker. While human decision-making is a complex process that must take into account the experience, values, priorities, attitudes and factors related to the animal and the individual, in addition to economic factors.

2. Material and Methods

The research was carried out on the basis of agricultural enterprises engaged in breeding cows of Holstein and Simmental breeds. In order to analyze the actual number of culled dairy cows and to determine its norm, studies were conducted in 9 farms for Holstein and 7 farms for Simmental breeds located in regions of Kazakhstan with different climatic zones, including East Kazakhstan, West Kazakhstan, Akmola, Aktobe, Almaty, Kyzylorda, Pavlodar and South Kazakhstan regions.

The collection of phenotypic data, productivity and health of cows was carried out in the period from 2019 to 2021 on the livestock of animals in the amount of 35,307 heads, including 18,462 heads of Simmental breeds and 17,862 heads of Holstein.

Based on the research, the main indicators of the reasons for the retirement of dairy cows were formed, which included: low productivity, low exterior indicators, gynecological diseases that reduce the indicators of the reproductive system, hoof diseases, udder diseases, as well as other reasons for the retirement of animals. The collection of information was carried out according to the primary zootechnical documentation of farms.

To obtain descriptive statistics, the standard MS Excel add-in "Analysis Package" was used - the analytical tool "descriptive statistics", to which sets of primary data for the studied years were transferred (Bostanova et al., 2022).

The statistics were processed using R Studio (Çetinkaya-Rundel, 2022).

3. Results and Discussion

Culling is the removal of animals from the main herd for various reasons, such as sale, death, etc. In turn, culling can be voluntary and forced, voluntary happens when an animal dies for various reasons, involuntary is carried out by a person. At the same time, culling is a lot of work, it can also be called the final stage of breeding work for breeding farms.

The sale is also called an arrangement, this is when low-yielding animals are not sent for fattening with subsequent slaughter, but are sold to other farms for which the level of productivity of an individual is average for the buyer's herd.

Simmental breed. The indicators of cow retirement for the Simmental breed, depending on age, are shown in Figure 1.

According to the conducted studies and biometrically processed digital material (Figure 1), cows of 2 and 3 lactation leave the herd most of all, 20.5 ± 1.7% and 21.1± 3.8%, respectively, which suggests that with increasing age of animals, the number of disposals also increases for one reason or another.

At the same time, studies were conducted on the percentage of animal disposals for some reason of all age groups. When determining the reasons for disposal, the following results were observed (Table 1).

Analyzing Table 1, we can conclude that the 1st place in the disposal of cows of the Simmental breed for specifically

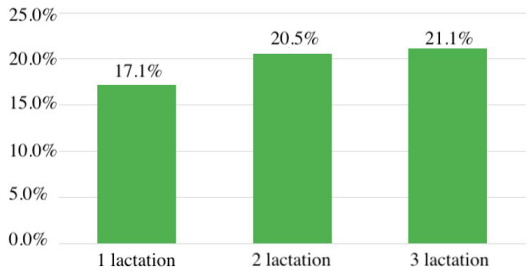

Figure 1. Average annual retirement of cows by lactations of the Simmental breed.

Table 1. The number of retired cows of the Simmental breed for various reasons.

Age group	Head of cattle dropped out	Dropped out for reasons, heads of cattle					
		NP	NE	NVF	BC	BV	DP
1 lactation	636	157	18	134	82	91	154
2 lactation	721	133	7	127	172	83	199
3 lactation	713	130	2	99	187	76	219
The overall result	2070	420	27	360	441	250	572

Note: NP – low productivity; NE – exterior disadvantages; NVF – low reproductive function; BC – hoof diseases; BV – udder diseases; DP – other reasons.

identified reasons is hoof disease, for this reason 441 heads were eliminated, most of all for this reason cows of 2 and 3 lactation are eliminated 28% and 30%. On the 2nd place, for reasons of low productivity, 420 heads or 20% of animals were culled out of 2070 lactating cows that participated in the sample. For reasons of udder diseases and deficiencies in the exterior, the outflow of breeding stock from the herd is less, 279 and 246 heads, respectively. The third significant reason is the problems of reproductive function, of the 526 dropped out for this reason, the largest share falls on the first heifers – 134 heads or 25% of the total number, which, according to farmers, "cannot be inseminated, because they simply do not come to hunt." At the same time, other reasons account for a large share of the disposal of 37% of the total retired livestock of animals, these reasons, according to farmers, include injuries, natural waste, etc.

Studies of the reasons for the retirement of cows from the main herd, conducted by scientists from near and far abroad, have shown that a large share of the retirement is occupied by low productivity and problems of the reproductive system.

The results of studies of the retirement of Simmental cows in various regions of the Republic of Kazakhstan are presented in the histogram (Figure 2).

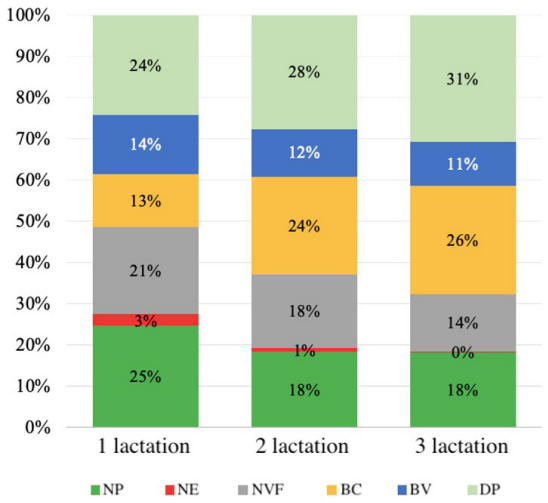

Figure 2. The number of disposal of cows of the Simmental breed. Note: NP – low productivity; NE – exterior disadvantages; NVF – low reproductive function; BC – hoof diseases; BV – udder diseases; DP – other reasons.

It can be seen from the figure that cows of different lactation have different disposal rates for various reasons, only two indicators can be noted that do not change significantly with age: udder diseases and exterior defects by 2-3%. At the same time, due to the shortcomings of the exterior, only cows of the 1st and 2nd lactation are eliminated, and cows of the 3rd lactation are not culled at all for this reason. This is due to the fact that cows are evaluated annually, and cows with inherited exterior defects are not suitable for breeding.

Most of the cows of the 1st lactation are removed from the herd after evaluating their 1st milk yield, i.e. when evaluating productivity, farmers understand that if the productivity of a cow does not correspond to that described in its passport, the only correct solution for the economic growth of the farm will be to remove this cow from the herd. So every fourth retired cow from the herd was culled precisely because of low productivity (the share is 25%). Also, cows of the 1st lactation are removed from the herd due to low reproductive function, according to the farmer, the first heifers that do not come to hunt by the 150th day of maintenance are culled. Almost a quarter of the first heifers leave the herd for other reasons, in which there are also reasons for natural care (death), 24% drop out of the herd during the first lactation. Udder and hoof diseases in 1-lactation cows are less common, 13-14% for both reasons.

With age, on the contrary, the reason for the retirement of cows due to hoof diseases increases, if by the 2nd lactation cows drop out of the herd for this reason by 24%, then by the 3rd lactation they leave the herd - 26%. Retirement for various reasons also increases with the age of the cow, if 28% cows leave during the 2nd lactation, then by the 3rd lactation by 31%. Due to the low reproductive capacity of cows, they go less and less with age, most likely this is due to the fact that cows with low fertility are detected at an early age, as a result of which 18% in the 2nd lactation this indicator decreases by 4% and becomes 14%.

If after the 1st lactation, a quarter of the retired cows leave the herd due to low productivity, then full-aged cows for this reason, both the 2nd and 3rd lactation leave by 7% less. This is also due to the fact that cows with low productivity are culled immediately after the first bonitation, and with age there are fewer such cows in the herd.

Thus, the largest number of cows of the 1st lactation leave due to low productivity, and with age there is an outflow of animals for reasons of hoof disease and categories of various causes.

We were also interested in how the level of dairy productivity affects the longevity of cows, for this we calculated the correlation between the percentage of cow retirement and their productivity in general, but also in the context of each lactation. The data is presented in Table 2.

In general, the cows of the Simmental breed in the general population do not have any relationship between productivity and the share of cow retirement. However, it can be noted that in cows of the first lactation, this indicator was negative, although low, also in cows of the 2nd lactation. By the 3rd lactation, this indicator becomes positive, although again low. Thus, it can be concluded that with age and increased lactation, the proportion of retired cows of the Simmental breed also increases.

Holstein breed. A similar analysis of animal culling data was obtained and processed for the Holstein breed. The following figure shows the retirement of Holstein cows depending on age (Figure 3).

Figure 3 shows that, unlike the Simmental breed, the retirement of cows increases sharply with age. Analysis of statistical data showed that the disposal of cows of the 1st lactation was 12.8%. Thus, 646±10.9 heads were eliminated from 5057±24.3 heads. The number of cows of the 2nd lactation in the sample involved less than 3,435 ±29.8 heads, 23.2% of them dropped out, which amounted to 797±19.2 heads. Cows of the 3rd lactation are eliminated from the entire sample the most, so from full-aged cows 3883 ± 50.6 heads, 1267 ± 31.2 heads or 32.6% were eliminated, which is 3 times more than the first heifer.

At the same time, studies were carried out on the percentage of animal disposals for some reasons of the disposals of all age groups of the Holstein breed. When determining the reasons for disposal, the following results were observed (Table 3).

As for the Simmental breed, the same retirement factors were taken into account for the Holstein breed. If the number of departures from simmentals does not increase much with age, then the picture for the Holstein breed animals is completely different. So, there is a difference in the number of retired heads between the 1st and 2nd lactation - 151 heads, while the difference between the 3rd and 2nd lactation was 463 heads.

The largest number of cow disposals is observed in the category of other causes, for example, such as injuries, internal non-contagious diseases or, as previously discussed, death. The number of retired animals in the 1st and 2nd lactation was 318 and 311, respectively, then by the 3rd lactation it becomes 126 heads more or 35% of the total retired livestock for this reason.

Cows are eliminated least of all in the age aspect due to exterior flaws, this is due to the fact that individuals of the Holstein breed bred or imported are breeding animals with characteristic breeding characteristics. Most holsteins at all ages are culled from the herd due to low fertility, as well as hoof diseases. The number of heads dropped out due to udder diseases increases with age, if 38 heads dropped out in the 1st lactation, then by the 3rd lactation it is almost 4 times more.

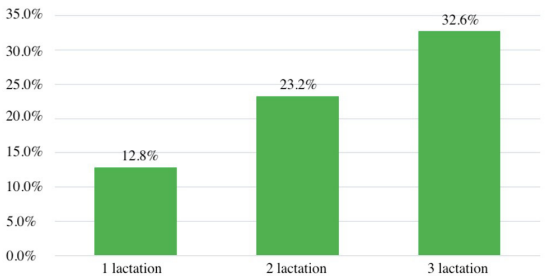

Figure 3. Average annual retirement of cows by age groups of the Holstein breed.

Table 2. The relationship between cow productivity and the percentage of their culling.

Indicator	General	1 lact	2 lact	3 lact
Milk yield, kg	4982±154.1	4747±216.8	5022.0±278.6	5177±303.1
% cull	19.4±1.6	16.2±2.1	18.8±1.7	23.2±3.8
Correl	0.09	-0.28	-0.16	0.29

Table 3. Number of retired Holstein cows for various reasons.

Age group	Head of cattle dropped out	Dropped out for reasons, heads of cattle					
		NP	NE	NVF	BC	BV	DP
1 lactation	646	65	36	103	86	38	318
2 lactation	797	89	43	142	126	86	311
3 lactation	1267	149	76	266	190	142	444
The overall result	2710	303	155	511	402	266	1073

Note: NP – low productivity; NE – exterior disadvantages; NVF – low reproductive function; BC – hoof diseases; BV – udder diseases; DP – other reasons.

Figure 4 shows the indicators of disposal by groups of Holstein cows.

The figure shows that almost 50% of the first heifers leave the herd for various reasons. With the age of cows, this indicator does not decrease evenly. If the difference between the first heifers and the 2nd lactation is more than 10%, then the difference between the 2nd and 3rd lactation is 4%.

As practice shows, only 10% of Holstein cows are culled from the herd due to low productivity, because Holstein cows bred in Kazakhstan are highly productive compared to other dairy breeds. So, for this reason, only 10.1% of first-born heifers dropped out, with age this indicator increases by only one percent, cows of the second calving 11.2%, full-aged 11.8%. The same stability in the share ratio is shown by such a reason for disposal as exterior defects of 5.4-6%, the reason is most likely the same as that of repair heifers. Breeding animals are separated, so that they do not inherit any defects of the external structure in their offspring.

With each lactation, the level of milk productivity increases in Holstein cows, and along with the increase in cow productivity, the proportion of cows that are culled due to udder diseases increases, according to the farmer, highly productive cows are more susceptible to mastitis, because there is atrophy of the udder lobes due to the use of hardware milking. If there are only 5.9% of the first heifers that have dropped out of the herd due to udder disease, then by the 2nd lactation they become 2 times more, that is, 10.8%, and by the 3rd lactation this indicator is at the level of 11.2%.

The same trend is with hoof diseases, if the first heifers leave the herd for this reason 13.3%, then cows of the 2nd calving are 2.5% more, whereas this indicator by the 3rd lactation, on the contrary, decreases by 0.8%.

According to the generally accepted position that high milk productivity negatively correlates with cow fertility, the research data is direct proof of this. With age, and therefore with increased productivity, cows on this basis are culled from the general herd with each subsequent lactation by an average of 2.5% more. First-heifers do not come hunting for a long time, since high productivity strains all the vital functions of cows very much, in order for them to restore their internal reserves, they need the best feed and normalized rations, and in the absence of these indicators, the proportion of first-heifers who left the herd for this reason is 15.9%. Further, in the next lactation, this indicator increased by 1.9%, and amounted to 17.8%. With age, the reserves of the body are exhausted more and by the 3rd lactation, cows that have left the herd due to low reproductive function become 3.2% more, namely 21%.

Thus, Holstein cows drop out of the herd mainly for other reasons, then there is an outflow of cows from the herd due to low reproductive function and udder diseases.

The data of the correlation between the percentage of cow disposal and their productivity of the Holstein breed are presented in the following Table 4.

A positive trend has been observed for the Holstein breed in the general population and in particular for lactation, with an increase in productivity, the percentage of culled animals also increases. So for all the animals that we selected in all farms, the correlation coefficient was positively low between the indicators taken into account and amounted to 0.33. For cows of the 1st and 2nd lactation, this relationship was also positive, and even at the same level, that is, 0.35-0.37. However, with the age of animals and an increase in productivity and the proportion of culled animals, this relationship decreases to 0.20.

To date, the results of research by scientists from near and far abroad show that at least 25-30% of cows are culled annually on dairy farms.

If a high level of culling of cows (more than 35%) is registered in farms engaged in breeding dairy cattle, it is necessary to take measures to correct it. Before taking any measures, it is important to comprehensively assess the situation and determine the reasons for culling cows and heifers. This is usually the hardest thing to do. The fact is that animals can be sick with a number of diseases, of

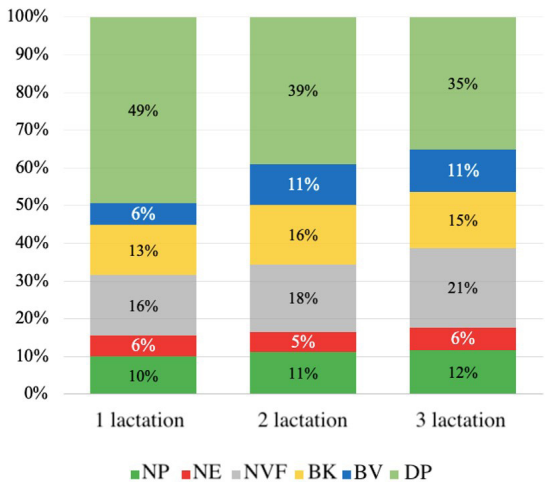

Figure 4. The share of reasons for retirement by groups of Holstein cows. Note: NP – low productivity; NE – exterior disadvantages; NVF – low reproductive function; BK – udder diseases; BV – hoof diseases; DP – other reasons.

Table 4. The relationship between cow productivity and the percentage of their culling.

Indicator	General	1 lactation	2 lactation	3 lactation
Milk yield, kg	6631±293.9	5849±450.1	6770±484.5	7273±553.3
% cull	20.9±2.6	11.0±2.4	19.4±3.9	32.4±5.4
Correl	0.33	0.35	0.37	0.20

which it is often difficult to distinguish the primary one. For example, if the question is raised about the culling of a cow with a low level of productivity, not pregnant, who has lameness on one of the limbs, which of these reasons should be chosen? Many would probably denote low productivity or yalovost. However, in this case, the main cause may be lameness, and a decrease in milk productivity and a violation of reproductive function is only its consequence. Work to identify the causes of culling in farms should be carried out on an ongoing basis.

In the work of J. Dubuc, J. Denis-Robichaud (Breuer et al., 2000; Dubuc and Denis-Robichaud, 2017) presents the results of studies conducted on 126 dairy herds. Scientists have studied the prevalence of postpartum diseases, reproductive indicators and postpartum culling. The prevalence varied greatly in different herds and ranged from 0 to 80%. Risk factors for herds with a high prevalence of postpartum culling were hyperketonemia ≥23.1%, placental integrity ≥4.9% and displaced rennet ≥4.0%.

Thus, many studies have shown a link between reproductive diseases during pregnancy and subsequent reproductive activity and their rejection. Studies by a number of scientists have proved that cows affected by purulent vaginal discharge and cytological endometritis had worse reproductive indicators in the last (Vieira-Neto et al., 2014; Denis-Robichaud and Dubuc, 2015). These studies have also been confirmed in the scientific publications of R.B. Walsh, D.F. Kelton, T.F. Duffield, K.E. Leslie, J.S. Walton, S.J. Le Blanc (Walsh et al., 2007), J. Dubuc, T.F. Duffield, K.E. Leslie, J.S. Walton, S.J. Le Blanc (Dubuc and Denis-Robichaud, 2017).

The negative impact of lameness diseases on milk yields, fertility indicators, animal welfare and premature culling has been described by many researchers (Kofler et al., 2021; Fürst-Waltl et al., 2021; Bicalho et al., 2007; Gundelach et al., 2013).

Many scientists believe that the basis for effective monitoring of the condition of the hooves of dairy cows is the regular electronic registration of the evaluation of hoof condition data obtained at each visit for hoof trimming. Their automatic analysis using graphical diagrams illustrates various parameters, and data can be stored in national breeding companies or other institutions (Kofler, 2013; Nielsen, 2018). Such centralized national registration of hoof health data, regularly transmitted by professional trimmers, has already been established in many countries (van der Linde et al., 2010; Strauss et al., 2021). In the Netherlands and Scandinavia, this has long been established for a very large percentage of dairy cows.

The comparative analysis system in Sweden compares the hoof health of approximately 66% of national dairy cows using regularly recorded data (Sandgren et al., 2009; Åkerström, 2020). A similar tool was implemented in the Danish herd management system SEGES (Raundal, 2021). Recently, key indicators of the prevalence of lameness, seven hoof lesions and annual culling due to hoof disease have also been established in Switzerland (Huber et al., 2020).

This data can be used for genetic improvement, providing tools for herd management and creating a system for comparative analysis of hoof health.

Korean scientists Jiseob Shin, Jaegu Lee, Juhyun Cho, Changgwon Dang, Taejeong Choi, Changhee Do, Jungjae Lee and Seokhyun Lee (Shin et al., 2022) conducted studies to assess the genetic indicators of longevity of life in accordance with the lactation period on a multiple equivalent animal model in Holstein cows. The Nonghup Dairy Cattle Improvement Center collected 1,702,304 records and used them as pedigrees through the Korean Animal Improvement Association. The lactation period was divided into early lactation (0-90 days: L1.1, L2.1 and L3.1), middle lactation (91-299 days: L1.2, L2.2 and L3.2), and late lactation (300 days - the following genus: L1.3, L2.3 and L3.3). The heritability of longevity for the first, second and third parts was 0.020, 0.028 and 0.039, respectively. In all births, heritability and late lactation were higher than at the beginning and middle of lactation. Most of the genetic correlations for survival in the first parity were higher than in the second and third parities. The results of this study can serve as a basis for the development of a more accurate model for assessing the characteristics of longevity in South Korea.

Analysis of the literature data of scientists around the world makes it possible to conclude that genetic and paratepic factors affect the productive longevity of animals. And the culling of breeds of world selection is in the range of 30-35%. Considering that the correction of genetic factors is a very laborious process (the heritability coefficient for the duration of economic use, according to the above sources, is within 0.1 ... 0.3), and paratypical factors can not always be corrected, in highly productive cows, it is recommended that the percentage of cows leaving the main herd should be considered at the level of 30-33%.

4. Conclusions

Conducted scientific studies have shown that the share of disposal of cows of the Simmental breed is 19.7%. At the same time, for Holstein cows, this indicator is set at 22.9%, respectively.

When analyzing the retirement of cows of the Simmental breed, it was observed that by the 3rd lactation, every 4th cow dropped out of the herd due to hoof disease (from 13% to 26%), and low reproductive function (from 21% to 18%). At the same time, moderate attrition was observed due to low productivity (from 25% to 18%). The smallest indicators of disposal were shown by the category of exterior defects, by the 3rd lactation of cows they are completely absent.

Holstein cows experienced an increase in disposals in all categories except for disposals for various reasons. The biggest difference in retirement between 1, 2, 3 lactation was observed due to udder disease 5.9%, 10.8%, 11.2% accordingly. The same pattern is observed in terms of reproductive function, if the share of retired first-born heifers was 15.9%, then in cows of the 3rd lactation this indicator increased to 21%.

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