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Evaluation of slaughter cattle grades and standards of cull cows

A. P. Palii[1*], N. G. Admina[2], S. A. Mihalchenko[3], I. M. Lukyanov[1], S. A. Denicenko[1], P. V. Gurskyi[1], A. P. Paliy[4], Y. O. Kovalchuk[5], V. A. Kovalchuk[6], O. L. Kuznietsov[6], A. S. Gembaruk[7], A. V. Solodchuk[7]

[1]Kharkiv Petro Vasylenko National Technical University of Agriculture 44. Alchevskih St., Kharkiv, 61002, Ukraine.
[2]Institute of Animal Science NAAS of Ukraine
1A Livestock breeders St., Kharkiv, 61026, Ukraine.
[3]Kharkiv National Agrarian University named after V.V. Dokuchaev
p/o "Dokuchaev-2", training camp of KNAU, Kharkiv region, Kharkiv, 62483, Ukraine.
[4]National Scientific Center "Institute of Experimental and Clinical Veterinary Medicine"
83 Pushkinska St., Kharkiv, 61023, Ukraine.
[5]Uman National University of Horticulture
1 Provulok Internatsionalniy, Uman, Cherkasy region, 20305, Ukraine.
[6]Ivan Kozhedub Kharkiv National Air Force University
77/79 Sumska St., Kharkiv, 61023, Ukraine.
[7]Pavlo Tychyna Uman State Pedagogical University
2 Sadova St., Uman, Cherkassy region, 20300, Ukraine.
**Corresponding author e-mail: paliy.andriy@ukr.net*

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Recently, due to the widespread implementation of intensive milk production technologies, the requirements for the type of animal physique have increased, because the theory and practice of breeding have proved that the economic and long-term use of cows is not possible without taking into account their exterior features and type of the constitution. The influence of the traits of the animals' physique on the duration of their economic use was studied, and the main slaughter grades and standards minimum percentage of cows determined beaf cow culling were determined. We selected the criteria mainly caused the cattle removing from the herd: growth scale of score 4, sacral inclination – score 6, limb posture from rear and side views - score 5. The percentage of cattle culling with body condition score score ranged from 7 to 9 was determined.

Keywords: Cow; Dairy herd; Linear exterior trait; Score; BCS; Productive longevity

Introduction

The success of the rational use of the animals' natural resources depends on the genotype, the technology applied, the level of livestock feeding and the professional training of the personnel. Each of these factors is of particular importance in the process of forming a highly productive dairy herd.

The history of the formation of the gene pool of dairy cattle had three periods. The first lasted until the beginning of the XX century, when a large role was played by a natural selection. The second period, until 1950, was characterized by the creation of new breeds of dairy cattle. The third, the modern one, is characterized by the reduction of both breeds and total number of livestock (Berry & Kearney, 2011; Wang et al., 2016). With every year, we observe a growing interest in the problems of biorhythmology, the methodological principles of which penetrate into the study of all levels of living physique - from the molecule to the level of the whole organism. And this is understandable, taking into account that for millions of years of evolutionary development, not only the process of continuous complication and improvement of the structural organization of living systems, but also the process of their temporary organization took place. The adaptation of the organism to constantly changing environmental conditions was provided not by separate organisms, but by time and space coordinated and specialized functional systems subordinated to each other (Ippolitova et al., 2019; Paliy et al., 2018). It is no coincidence that ecological and physiological mechanisms of adaptation to habitat are being investigated through research into the temporal organization of biosystems and scientific-based means of correction of biological processes occurring in a living organism are being sought.

For many years, the main focus of animal breeding has been to increase their productive potential. The result of such breeding in many cases has been a sharp increase in energy expenditure on farm animals and significant environmental pollution (Akinbile et al., 2016; René, 2011). Currently, breeding aiming to increase adaptive capacity is becoming more widespread (Rodriguez-Bermudez et al., 2019; Romanenko, 2007; Yusuf et al., 2010). In addition, for economic reasons, it matters what type of livestock should be guided when working with the breed in a particular natural and economic zone.

The leading selection value in the aspect of genetic improvement of the productivity of the herd and the longevity of its cows belongs to the selection of animals on the basis of exterior type (Camara et al., 2019; Paliy, 2016; Rodrigues-Bermudesz et al., 2019). Only animals with good health, adapted to the harsh conditions of use on industrial complexes, can guarantee high rates of life-long productivity (Berry, 2018; Kern et al., 2015; Palii et al., 2019a). One of the main factors for successful breeding of dairy cattle is the level of relative variability in the linear features of the exterior with dairy productivity. Positive and reliable association with milking rate is observed on most of the descriptive features that are important in breeding: height, body depth, angularity, width of buttocks, posture of pelvic limbs, angle of hooves, front and rear attachment of the udder, central ligament and displacement ($r = 0.198$-0.464, $p<0.001$) (Khmelnychyi et al., 2018). The modern world strategy of breeding work with the dairy herd involves the use of multi-vector breeding with widespread use of index selection. In this case, the preference is given both to the productive (output of milk protein and fat, and to a lesser degree - a milk yield), and to the functional (duration of economic use, somatic cell content, limb strength, fertility, etc.) signs of cows the frequency of which in the complex breeding system estimates up to 29-80 and 20-71%, respectively (Bell & Tzimiropoulos, 2018; Osipenko et al., 2018).

Research on this issue has been of great importance in recent decades, as evidenced by publications by scientists in advanced dairy farming. The share of this trait in the overall assessment of breeding value is: in Germany - 6%, in France - 13%, in the Netherlands - 12%, in the United States - 13%, in Canada - 8%, in New Zealand - 10% (Damasceno & Calmon, 2015; Effa et al., 2013). The practice of using cattle has convincingly demonstrated that the economic efficiency of milk production is largely driven by factors such as the genetic potential of cows and the duration of their productive use (Palii et al., 2019b; Pidpala & Zaitsev, 2018). Therefore, the studies on the duration of commercial use of dairy breeds are important both for the high profitability of production and for the use of such animals in the selection process, and the preservation of all species diversity of animals, protection of their habitat, breeding conditions, rational use and reproduction of wildlife is the main requirement of the present in the common system of nature management. Thus, determining the BCS and linear features of the physique of dairy cows associated with their in the herd remains a pressing task.

Material and Methods

The percentage of cows removed from the herd was calculated as the ratio of the number of animals that left the herd during lactation to the number of cows that calved. Depending on the results of the scoring of the individual linear features of their physique, the animals were divided into groups.

The productivity of the cows on the experimental farms was 5000-6000 kg per lactation. To determine the patterns of the effects of exterior indicators, a linear assessment of animals was performed using the 'ICAR' (ICAR Guidelines approved by the General Assembly held in Kuopio, 2006). Thus, according to the method for linear assessment, each of the characteristics has its own value and was ranged with score from 1 to 9. Scores 1 and 9 are extreme values of traits. The assessment was carried out visually and, for the sake of clarification, measuring instruments were used. Animal BCS was evaluated by the shape of the line formed between the pin bones, hip joint, and sciatic tubercle (Legoshin & Sharafeeva, 2015). We used correlation and analysis of variance to process our experimental data.

Results and Discussion

According to our results the number of cull cows depends on their height (Figure 1).

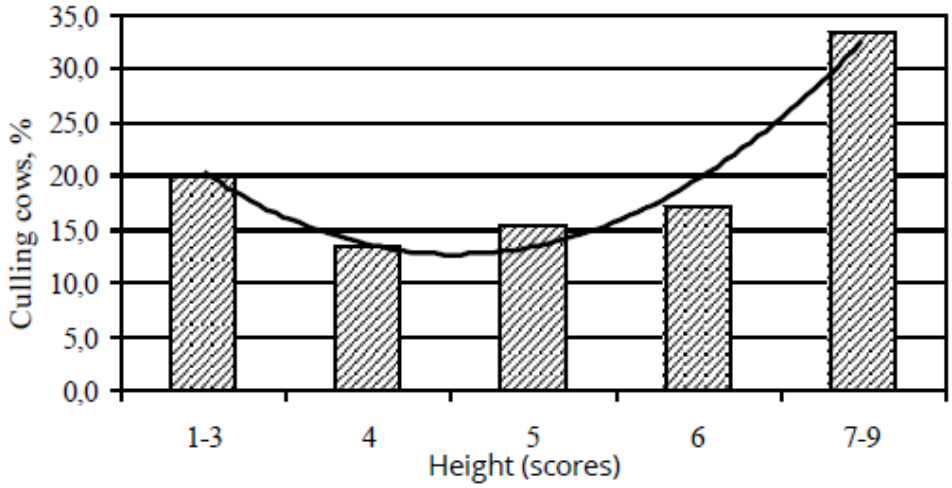

Figure 1. Dependence between number of cull cows and their height.

The lowest percentage of culling out was observed in medium-height cows with a score of 4 (13.3 ± 1.4%) and the highest in the group of low-height animals with a score of 1-3. The culling of the latter was 20.0 ± 3.1%, which is 6.7% more than in the group of cows with a score of 4 ($p<0.01$). High animals (score 7-9) were also characterized by higher percentages of culling on a level of 33.3 ± 19.2%. However, differences in 20% of cows with a score of 4 were statistically irrelevant ($p>0.05$).

A higher percentage of low-height culling cows is due to their lower productivity, which for 80-90 days of lactation was the lowest for both tied and loose housing. The dependence of culling cattle on their chest width and body depth was similar to the preceding one (Figures 2 and 3). The animals with an average estimate of chest width and body depth (score 5) had the lowest percentage of cull cows, 15.4 ± 2.1% and 12.3 ± 1.9%, respectively. The cows with an estimate that deviated from the mean estimate of chest width and body depth were cull more often, but differences between these groups were unlikely ($p>0.05$).

When determining the dependence of the cull cows on the angle of their sacral slope, it was found that the percentage of cull cows with an estimation of the sacral slope with score 6 was the smallest and was 12.9 ± 2.1% (Figure 4).

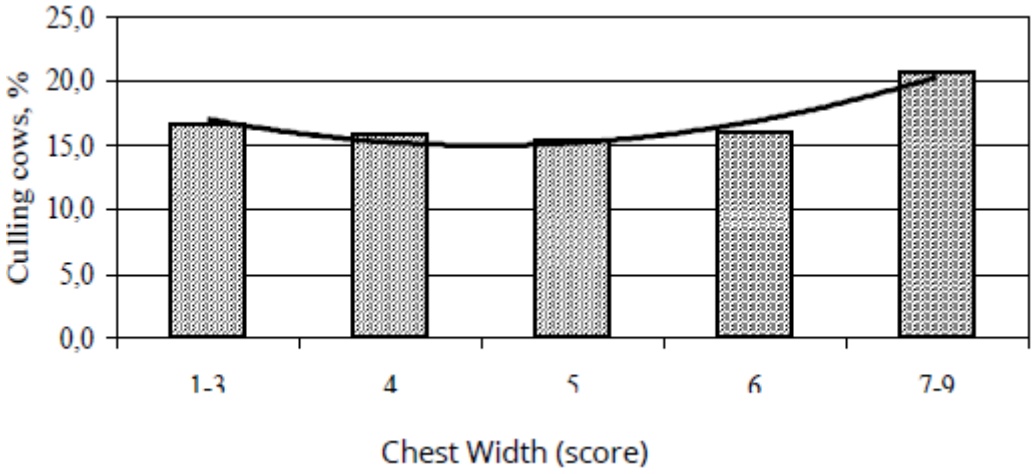

Figure 2. Dependence between the number of cull cows and the width of their chest.

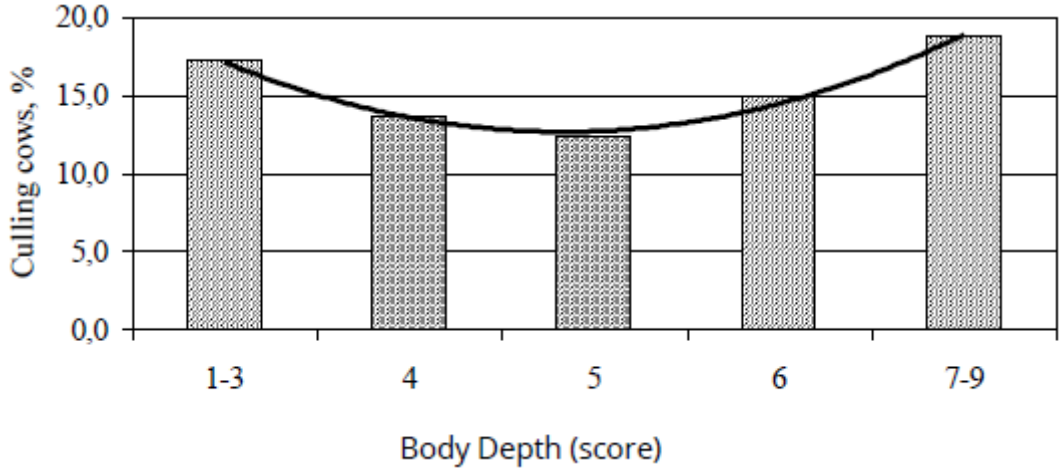

Figure 3. Dependence between the number of cull cows and their body depth.

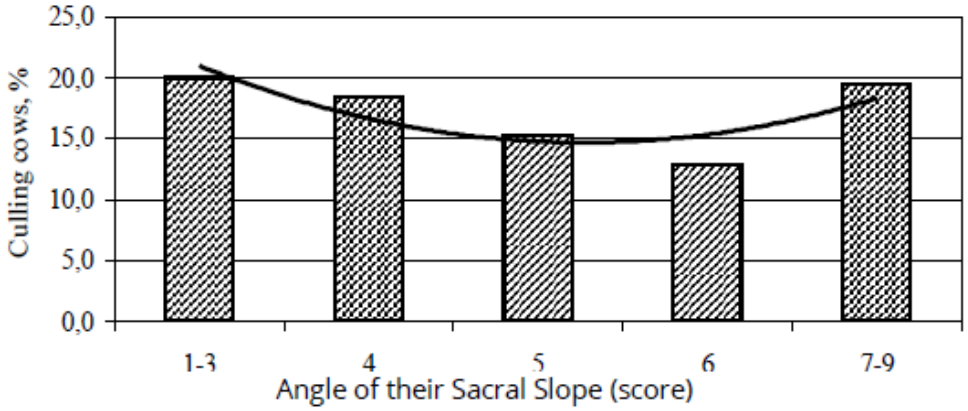

Figure 4. Dependence between the number of cull cows and angle of their sacral slope.

The largest number of cull cows had a score of 1-3 and 7-9s, which was 20.0 ± 8.0% and 19.4 ± 2.8%, respectively. The difference in the number of cull cows between the groups with a score of 6 and 7-9 was significant ($p<0.01$). These differences are explained by the better reproductive capacity of cows. The average duration of the service period in the respective groups was: with a score of 6 it were 143 ± 10 days, and with a score of 7-9 were 177 ± 16 days. As for the width of the sacrum, according to our data, it did not have a significant effect on the percentage of cull cows.

Trends were determined concerning the number of cows left the main herd, depending on the posture of their rear limbs (Figures 5 and 6).

The animals with desirable posture of rear limbs were retained better. The cows with evaluation of limb posture of 5 point were cull in 12.1 ± 2.2% for the lateral view and 13.5 ± 2.3% for the rear view. The difference between the percentage of cull cows, which had the mean score and the score of 1-3 and 4 was unlikely, and the differences between the mean score and score of 6 and 7-9 was at the trend level ($p<0.1$). An increase in the angle of incidence of the hooves slightly increased the percentage of the cows dropping out, but the difference in 0.5-3.8% of cases was unlikely. The share of the cull cows depending on their body condition score (BCS) is shown in Figure 7.

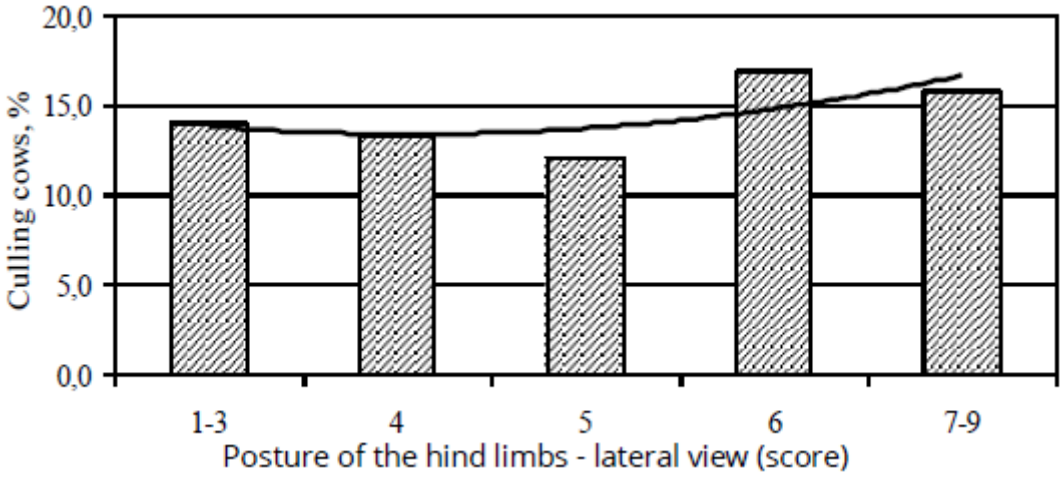

Figure 5. Dependence between the number of cull cows and their rear limb posture (lateral view).

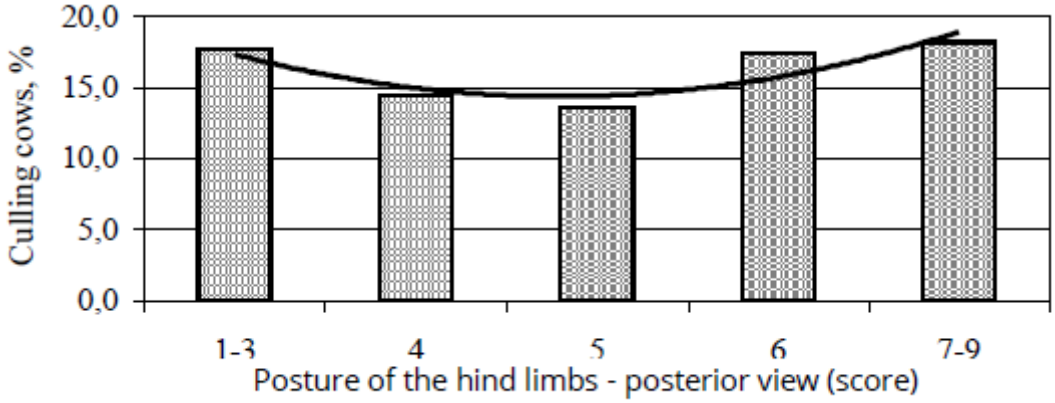

Figure 6. Dependence between the number of cull cows and their rear limb posture (posterior view).

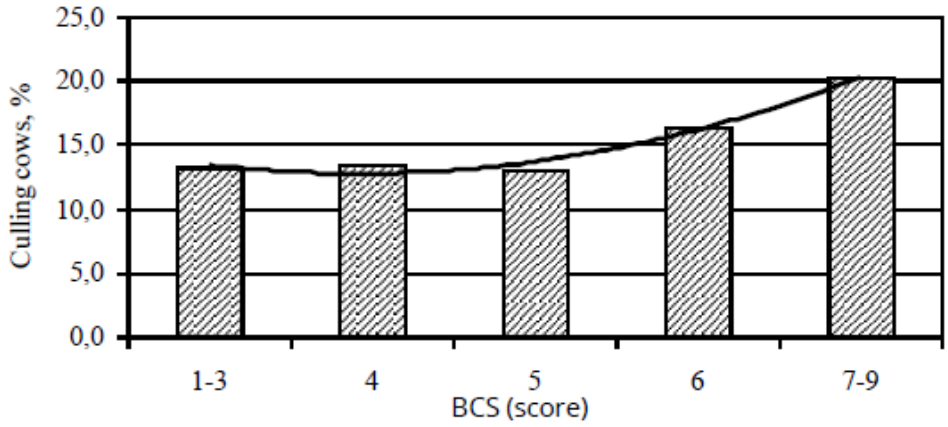

Figure 7. Dependence between the number of cull cows and their BCS.

The percentage of cull cows with the body condition score from 1 to 5 was virtually indistinguishable and ranged from 13.0 ± 1.9% to 13.4 ± 2.9%. With increasing BCS (score 7-9), it increased to 20.2 ± 2.2. A difference between groups in 6.8-in 7.2% of the cull cows significant ($p<0.01$). The cows with BSC from 7 to 9 was considered the obese (Figure 8).

An animal that becomes so fat begins to lose fertility as many hormonal glands start to function incorrectly because the fat in their body absorbs some of the hormones. High BCS of dairy cattle is a consequence of an unbalanced level of feeding that adversely affects the reproductive function, a low level of which causes animal culling. The conditions of existence of animals are so diverse that they constantly affect the speed and duration of growth, the accumulation of muscle and adipose tissue. Unbalanced feeding can be the reason that speeds up the processes of fat deposition. It also occurs due to different genetic potential due to different heredity of the body. Despite the careful selection of animals into groups by age, live weight and BCS, each individual, due to different heredity and individual characteristics, will respond differently to feeding and keeping conditions (Gogaev et al., 2019; Oishi et al., 2011 Theilgaard et al., 2002). In breeding practice, selection by exterior indices means indirect improvement of technological characteristics. Exterior defects can adversely affect productive longevity and ergonomic performance of the milking process. Nowadays, despite the dramatic changes in milk production technology, livestock farmers practically do not use fundamentally new, modern approaches to the organization of processes in the chain 'man - machine - environment - animal', because the technological processes of production of livestock products are quite complicated, both in the design and in their implementation. This complexity is explained by the fact that today's highly mechanized animal husbandry is characterized by a

complex biotechnical system consisting of three units: the human operator who manages the system, the animal that receives a large number of controlled and accidental actions, and the machinery (or mechanisms, premises and equipment) (Palii & Palii, 2019; Popechitelev & Bolsunov, 2009). In order to ensure the health and reproduction of animals, this system should be aimed at providing them with optimal comfortable living conditions.

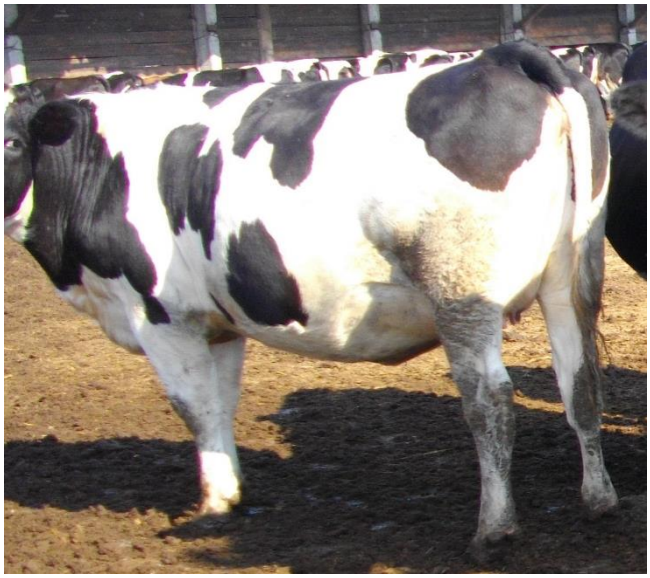

Figure 8. Cow with BCS of 7-9.

The scientists (Domingues et al., 2019; Paliy et al., 2015; Pretty, 2018) claim that in the coming years, a significant increase in the number of dairy herds will not happen - it will take decades to restore the dairy industry. Therefore, it is necessary to solve the problem of milk production through the intensification of the industry, the basis of which is determined by a high level of specialization and flow production. This, in turn, requires a certain standardization of animals by live weight, productivity, anatomic and physiological characteristics; and, above all, by the adaptation of cows to machine milking and by the resistance to diseases.
Particular attention should be paid to the ethical aspect of animal husbandry. It is also directly related to ecology, which is not limited to climate change, natural resources and the state of flora. Living organisms are an integral component of ecology, and attitude to them is an important indicator of environmental awareness (Herrero et al., 2016).
In recent years, the transformations, changes of ownership and economic management in the agro-industrial complex have not been accompanied by the expansion of the use of environmental and resource-saving technologies. The intensification of agriculture must be carried out not only by quantitatively increasing resources used, but, above all, by their more rational use. Therefore, the prospects for further research in dairy cattle breeding lie in the development, research and implementation of resource-saving and environmentally-friendly technologies that will be aimed at reducing direct labor costs, material consumption of production and production processes, compliance with environmental standards of impact on land resources and obtaining maximum output.

Conclusion

Proper application of the results of body type assessment in dairy cattle breeding contributes to the growth of cows' productivity and increasing the duration of their economic use, and aims to further improve economically beneficial traits in overall in the general system of nature management. The lowest percentage of cull cows was registered for the cattle with specific linear score assessment: height of 1 score (13.3 ± 1.4%), sacrum slope of 6 score (12.9 ± 2.1%), limb posture of score 5 from the lateral view (12.1 ± 2.2%) and from the posterior view (13.5 ± 2.3%). With the increase of BCS of dairy cows up to score 7-9, their dropping out from the herd is 20.2 ± 2.2%.

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