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EVALUATION OF LINEAR TYPE CLASSIFICATION BASED ON THE EXTERIOR CHARACTERISTICS OF THE BROWN CATTLE COWS OF DIFFERENT ORIGIN IN UKRAINE

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Abstract

The research was conducted in the aspect of preserving the gene pool of Brown cattle with the perspective of breeding animals with the desired conformation type, characteristic to the original Brown Swiss. In the Sumy region of Ukraine, a linear assessment of first-born cows of Brown cattle of different origin - Lebedyn, Ukrainian Brown dairy and Swiss breeds – was carried out. The level of interbreed variability in the development of linear type traits has been established. Results of the linear estimation revealed better indicators of the conformation type in cows of the Swiss breed, which characterize it as a specialized dairy. Lebedyn cattle correspond to the combined type by the linear type traits of linear classification. Ukrainian Brown dairy occupies an intermediate place between Lebedyn and Brown Swiss breeds. Linear assessment indicators confirmed the better development of limbs and body growth in the Lebedyn cattle compared to animals of the Brown Swiss and Ukrainian Brown dairy breeds. However, they were inferior in the development of technological features of the udder.

Key words**:** *Lebedyn, Ukrainian Brown dairy, Brown Swiss, conformation type, linear classification*

INTRODUCTION

The task of the world's dairy cattle industry is to constantly improve the economically useful traits of cows and to select the best by breeding value ones for reproduction. The accuracy of the selection is ensured both with the help of direct breeding information and indirect information obtained using linear type traits of the conformation, which are quite important for the dairy cattle improvement [1, 2, 3, 4, 5, 7].

The world breeding practice shows that in order to promote the health of dairy cows, increase the productive longevity and milk productivity, more attention should be paid to the enhancement of the conformation of cattle [13, 14, 16, 6, 32]. To achieve this, the conformation of cows is evaluated with the help of the linear evaluation technique. According to ICAR guidelines, the system of linear evaluation of dairy cows by the type includes the confirmative features of economic and functional value, or directly or indirectly related to breeding goals, including those ones aimed to improve the characteristics of the productive longevity [12, 15].

The brown cattle are presently known all over the world as one of the extremely hardy, highly adaptable breeds with a high performance potential. Being in extreme conditions, from tropical heat to changing weather conditions of highland climate with a scanty feeding level, cows of this breed are beyond compare in achieving high performance and trouble-free adaptation to various housing systems. Under optimal conditions brown cows are able to realize their high performance potential to the greatest possible extent. At the same time, the brown cattle are notable for a long period of being kept, which, in turn, has a very positive effect on their economic performance. Brown cows give high-quality, pleasant-tasting milk with a high capacity for cheese making due to the content of kappa-casein BB [4, 21, 24, 25].

Overall, such breeds as the Brown Swiss, Lebedyn, Brown Carpathian, Ukrainian Brown Dairy are bred from among the brown cattle in Ukraine. In the Sumy region, the most common is the Ukrainian Brown Dairy,

and the less common Lebedyn and Brown Swiss.

The Lebedyn (or Lebedynska) breed has been bred in Sumy region as a result of the restoration breeding of cows of local breeds (mainly, the Ukrainian Grey breed) with bulls of the Brown Swiss breed with the subsequent inter se breeding (from the second-third generation) of the best crossbreeds while improving the conditions of feeding and keeping animals.

The use of sires of the Brown Swiss breed of foreign breeding in the reproductive crossing with the Lebedyn cattle has resulted in the creation of the new Ukrainian brown dairy breed, officially approved as the breeding achievement in 2009 (the Order of the Ministry of Agrarian Policy and the National Academy of Agrarian Sciences of Ukraine No. 386/59 dated June 03, 2009)[3].

The concept of development of a new Ukrainian brown dairy cattle has provided for obtaining an animal type intermediate between parental breeds, which would be characterized by high yields and performance of the Swiss breed, with objective advantages of the mother one concerning the quality of milk, high adaptive capacity, constitutional strength and productive longevity [19, 20, 22].

Brown Swiss breed is spreading all over the world, especially it is very popular in Europe. There are reports about between 7 and 10 million Brown Swiss animals in the world [27]. However, against this background, the number of Brown Swiss of combined type, which at one time were used as parental stock in the creation of the Lebedyn breed, is currently quite small and they are kept as gene pool herds.

Similar types of Brown cattle have been preserved in some farms of the Sumy region since then, taking into account their original hereditary qualities, which are appreciated by the owners of Brown cattle in foreign countries - the best ratio of protein and fat in milk and a small number of somatic cells, high adaptability, excellent reproductive qualities, strong limbs and hoof horn, balanced, obedient temperament, long-term productive use [9, 10, 11, 27], need protection, preservation and improvement. World and domestic experience shows that the loss of breed diversity is not only the loss of unique and invaluable genetic diversity, but also the narrowing of genetic potential, which fundamentally limits the possibilities of breeding work in the present and the future [20].

Taking into account the importance of preserving Brown cattle in the original type, the purpose of our research was to conduct a comparative characterization of the body structure of animals of maternal, paternal and intermediate form, evaluated by conformation type, and to determine the variability of the assessed linear type traits.

MATERIALS AND METHODS

The conformation type was assessed in first-born cows of Brown cattle of various origins in the leading farms of the Sumy region according to the method of linear classification [17] by the latest recommendations of ICAR [12] at the age of 2-4 months after calving. Research indicators were worked out by biometric methods on a PC in the Microsoft Office Excel environment using the software according to the formulas described by Ladyka et al., 2023 [26].

RESULTS AND DISCUSSIONS

The linear evaluation of the firstlings of brown cattle of different origin, as estimated by the 100-point system of linear classification, showed the significant variability of its indicators within the control breeds (Table 1).

According to the results of linear classification of firstlings of brown cows of different origin, within 100-point estimation, a mongrel variability by its indicators is established. The firstlings of the Schwyz brown breed cows, with a score of 83.6 points, exceeding the cows of the same age of Lebedyn and Ukrainian brown dairy breeds with a significant difference of 2.4 and 1.1 points respectively ($P < 0.001$), are considered to be the best in terms of the dairy type. By the confirmative traits that evaluate the development of the barrel as “very good”, the

experimental groups of animals are almost indistinguishable.

The average grade for group characteristics of the barrel indicates a good overall strength of the animals of the brown breeds, the ability to consume roughage in large amounts, and the animals of the Ukrainian brown dairy and Schwyz breeds have good inclinations for high milk productivity.

The assessment of the linear traits that characterize the state of the legs is also important, because the current conditions of milk complexes with a firm flooring and excess moisture lead to severe complications and pathology of the legs of animals. There is some information that, being tied up, 40% of cows suffer of leg diseases, and when cows are kept in mono-block sheds, this figure reaches almost 90%. On dairy complexes, we can trace from 60 to 80% of leg diseases of cows, mainly of the hooves, among all the mechanical damages [30]. Therefore, the task of breeding is to minimize the negative impact of the harmful conditions of dairy complexes on the legs of animals by breeding and selecting animals that have strong legs.

Table 1. The results of the evaluation of the experimental breeds of brown cows by the type of conformation (points)

Conformation traits		**Breed**					
		Lebedyn breed		Ukrainian brown dairy breed		Schwyz breed	
		x ± S.E.	Cv,%	x ± S.E.	Cv,%	x ± S.E.	Cv,%
Quantity of animals		284		306		275	
Group of traits to characterize: dairy type		81.2±0.14	1.4	82.5±0.16	1.1	83.6±0.12	1.0
Barrel		83.8±0.16	1.3	83.2±0.13	1.2	83.8±0.18	1.2
Legs		82.8±0.17	1.5	81.4±0.12	1.4	81.8±0.12	1.3
Udder		81.4±0.15	1.2	82.9±0.13	1.5	83.5±0.15	1.4
Final evaluation		82.2±0.14	1.4	82.5±0.12	1.4	83.2±0.12	1.2
Descriptive traits: Height		6.2±0.18	18.2	6.5±0.15	15.3	6.8±0.19	12.4
Chest breadth		7.5±0.15	11.2	7.1±0.18	12.3	7.3±0.17	11.4
Depth of barrel		7.7±0.16	10.2	7.8±0.12	11.2	7.9±0.19	10.8
Angularity		5.2±0.17	12.4	6.3±0.10	11.2	7.2±0.15	9.7
Position of hindquarters		5.5±0.09	14.6	5.2±0.07	13.2	5.1±0.06	11.3
Width of hindquarters		5.2±0.13	13.7	5.4±0.11	12.5	5.6±0.15	10.4
Angle of ligament		5.3±0.11	12.1	5.1±0.12	17.4	4.9±0.12	14.2
Position of hind legs		6.9±0.18	12.3	6.2±0.15	15.3	7.1±0.10	14.4
Angle of hoof		5.5±0.10	12.7	4.6±0.09	14.3	4.9±0.15	15.0
Udder parts attachment	fore	6.4±0.18	20.4	7.2±0.14	16.1	7.6±0.15	14.9
	hind	5.2±0.17	18.4	5.9±0.13	17.3	6.3±0.17	15.8
Central arch		5.7±0.15	21.6	6.8±0.19	20.1	7.2±0.13	17.3
Depth of udder		5.8±0.16	21.1	6.5±0.14	21.8	7.1±0.18	17.2
Teats location	fore	4.6±0.21	24.3	5.8±0.17	22.8	6.2±0.28	20.5
	hind	5.1±0.21	22.1	6.2±0.17	21.4	6.5±0.28	17.6
Length of teats		6.8±0.11	14.4	5.6±0.14	14.2	5.4±0.11	12.1
Mobility		7.5±0.12	12.5	7.1±0.13	16.2	7.3±0.18	14.4
Fattening		7.8±0.13	14.3	6.5±0.11	13.6	5.7±0.15	12.5

Source: Own calculations.

The state of the legs of the Lebedyn breed cows, characterized by the development of its traits, is better revealed with an average score of 82.8 points. exceeding the cows of the same age of the Ukrainian brown dairy and Schwyz breeds with the difference of 1.4 and 1.0 points, respectively ($P < 0.001$).

The group of linear traits that characterize the dairy system is, at this stage of selection and retention conditions, the most important among the others, since their development depends not only on the productivity of the cows, but also on the adaptability and productive longevity, as evidenced by the

research conducted in this aspect [8, 14, 18, 28, 29, 31].

The Schwyz breed cattle is characterized by the best development of linear features used to evaluate the milk system, as evidenced by an average score of 83.8 points. The difference between the Schwyz brown breed and Lebedyn maternal lineage cattle by the group of udder traits is 2.1 points (P <0.001), and 0.6 points (P <0.01) compared to the Ukrainian brown dairy bred. That is, the use of the gene pool of the Schwyz breed made it possible to significantly improve the morphological characteristics of the udder in the breeding process of its transformation into Ukrainian brown dairy breed.

According to the final evaluation, which summarizes the estimates of the four group complexes, obtained by the weight coefficients, the Schwyz breed has got the highest value of 83.2 points, which testifies the best conformation traits of the dairy cows. The cows of the same age of the Lebedyn breed are far behind them by the total evaluation of the type by 1.0 point (P <0.001), and the Ukrainian brown dairy - 0.7 points (P <0.001).

The descriptive traits, unlike the group ones, differ in variability significantly, regardless of the breed being evaluated, with coefficients of variation within the range of 10.2-24.3% of the Lebedyn cattle, 11.2-22.8% of the Ukrainian brown dairy and 9.7 -20.5% of the Schwyz breeds. The slightly lower variability of the descriptive features of the Schwyz breeds indicates that they are more consolidated in type, and higher estimates indicate the enhancement of the conformation development.

In general, the high phenotypic variability of the assessment indicators for the development of the descriptive traits, especially concerning the height, attachment of the fore and hind parts of the udder, the depth of the udder and the location of the teats, indicates the need for systematic selection for the use of linear evaluation of the breeds studied according to the traits of conformation.

The Schwyz breed cows exceed the ones of the same age of the Lebedyn breed significantly by the following descriptive features, namely: height - by 0.6 points (P <0.05), angularity - by 2.0 points (P <0.001), width of hindquarters - by 0.4 points (P <0.05), attachment of the fore teats - by 1.2 points (P <0.001) and the hind teats of the udder - by 1.1 points (P <0.001), the central arch - by 1.5 points (P < 0.001), the depth of the udder - 1.3 points (P <0.001), the location of the fore and hind teats - 1.6 and 1.4 points (P <0.001) respectively, being far behind in fattening by 2.1 points (P <0.001). In compliance with the descriptive traits, the Ukrainian brown dairy breed cattle are located between the Lebedyn and Schwyz breeds.

Using the method of linear classification, we evaluated cows of leading herds of brown cattle of different origin applying the nine-point scale with the conformation profile diagram in the comparative analysis of such breeds as Lebedyn, Ukrainian brown dairy and Schwyz evaluated (Fig. 1, 2, 3). The level of evaluation of the development of the 18 descriptive traits of the cow's conformation, given in the diagram according to the linear classification method, indicates their specific intragroup variability.

The firstlings of the Lebedyn breed cows (Fig. 1) are slightly higher than the average ones (6.2 points), with good development of the chest width (7.5 points) with a deep barrel (7.7 points). Among the animals evaluated there are individuals with slightly flattened hindquarters, as evidenced by the assessment of the character of its position (5.5 points), and by the development in width, the assessment is closer to the average level (5.2 points).

It is well-known that the productive longevity of the dairy cattle in the conditions of the industrial complexes often depends on the strength of the hind legs, which is determined by the assessment of the angle and location of the ligament and hooves. The angle of the ligament of the Lebedyn breed cows is also at an almost optimal level (5.3 points). The state of the hind legs is characterized mostly as parallel one (6.9 points). The firstlings of the Lebedyn breed cows are considered to be better when characterized by the angle of hooves (5.5 points), with a significant superiority of the cows of the same age of the

Ukrainian brown dairy (4.6 points) and the Schwyz (4.9 points) breeds by 0.9 and 0.6, (P < 0.001) points respectively.

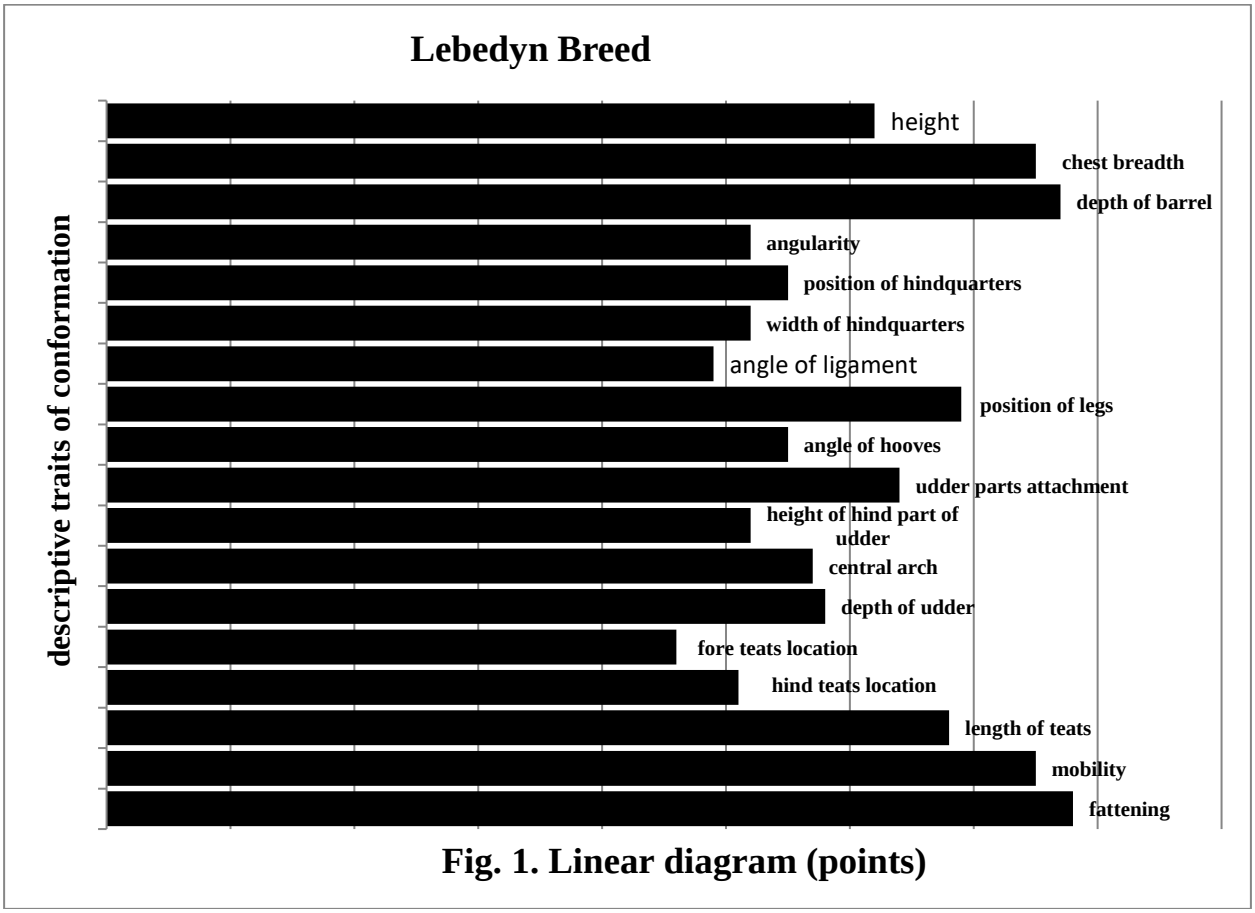

Fig. 1. Linear diagram for Lebedyn Breed (points)
Source: Own calculations.

The most important element of the linear evaluation is the characteristics of the dairy system. In all countries of the world, in the complex classification of the dairy cows by four groups of conformation traits with their independent assessment of the 100-point system, the largest proportion (40%) is occupied by the complex traits that characterize the udder, and six major morphologically important selective traits of udder are evaluated.

The attachment of the fore part of the udder is evaluated by the angle formed at the junction of the udder with the abdomen. Strong attachment of the udder is the most demanded trait highly appreciated. The best development of this type is characterized by the gradual transition of the glandular tissue of the udder into the abdomen through the suspensory lateral ligament to form a blunt angle. The rigid attachment of the udder does not allow it to sag with age. According to this trait, the Lebedyn breed cattle (6.4 points) are significantly far behind the cows of the same age of the Ukrainian brown dairy (7.2 points) and Schwyz (7.6 points) breeds by 0.8 and 1.2 (P <0.001) points, respectively.

The height of the attachment of the hind part of the udder also performs a restraining function and indicates the high level of potential yields. According to this trait, the Lebedyn cows (5.2 points) are also far behind the cows of the same age of the Ukrainian brown dairy (5.9 points) and Schwyz (6.3 points) breeds by 0.7 and 1.1 (P <0.001) points, respectively.

Similarly, the Lebedyn breed cows are far behind the rest of the morphological traits of the cows of the same age of the Ukrainian brown dairy and Schwyz breeds. Their central arch (5.7 points) is slightly shaped and udder (5.8 points) is more drooped, the teats (4.6

and 5.1 points) are located more closely to each other, and the length indicator (6.8 points) is far behind the optimum. This proves the necessity to enhance their morphological traits of udder by the rational selection of the herd bulls, evaluated by the conformation type of their breed.

The Schwyz breed, which was used as a maternal lineage in the process of breeding of the Ukrainian brown dairy breed when crossing it with the Lebedyn breed cattle and, being used to improve the breed recently bred, has been characterized by the best descriptive traits of linear evaluation(Fig. 2).

Having the height in sacrum of 6.8 points, the firstlings of the Brown Swiss breed cows were slightly superior to the Lebedyn and Ukrainian brown dairy breed ones of the same age by 0.6 and 0.3 points, respectively.

The desirable development of angularity trait, used to characterize high yields of animals, the firstlings of the Brown Swiss breed cows are considered to be the best in this respect, which is confirmed by their high evaluation (7.2 points). They have the best sacrum position (5.1 points) and well-developed width of hindquarters (5.6 points). The assessment of the angle of ligament (4.9 points) indicates that there are some animals with elephant position of the hind legs, and the assessment of the angle of hooves (4.9 points) is used to show the average level of the trait.

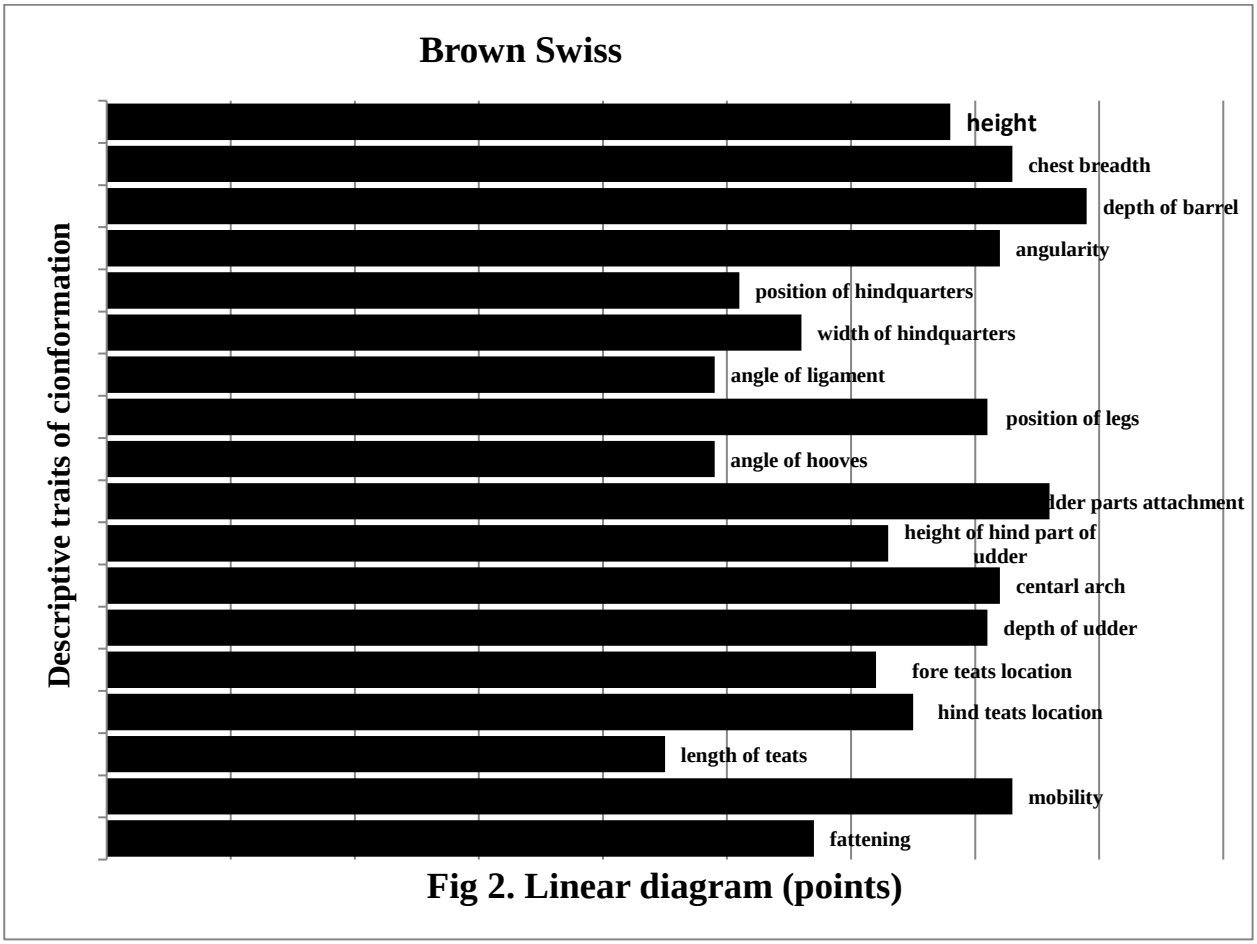

Fig. 2. Linear diagram for Brown Swiss Breed (points)
Source: Own calculations.

According to the linear evaluation of morphological characteristics, the udder of the Brown Swiss breed cow is vastly different from the Ukrainian brown dairy and Brown Swiss breeds. They have the highest assessment of the fore teats attachment (7.6 points), the hind teats attachment (6.3 points), their central arch (7.2 points), which performs a holding function, is sharply shaped, the udder is located high enough from the angle

of ligament (7.1 points). Taking into account all the traits of udder assessment, the difference in comparison with the Lebedyn breed cattle is vivid.

According to the estimation of the mobility trait (7.3 points), the firstlings of the Schwyzbreed cows are not far behind the Ukrainian brown dairy and Lebedyn breed ones, but by the fattening trait (5.7 points) they are significantly worse (1.3 and 2.1 points respectively).

According to the diagram, the level of estimation of the Ukrainian brown dairy breed in most cases is between the Lebedyn and Brown Swiss breeds.

Thus, the results of the linear evaluation of cows of brown breeds of Sumy region revealed the best efficiency of the conformation type of the Brown Swiss breed cows, which characterizes it as specialized dairy one. According to the linear classification, the Lebedyn breed cattle can almost be characterized as the combined type of productivity, and the Ukrainian dairy breed is between the maternal and paternal lineage (Fig. 3).

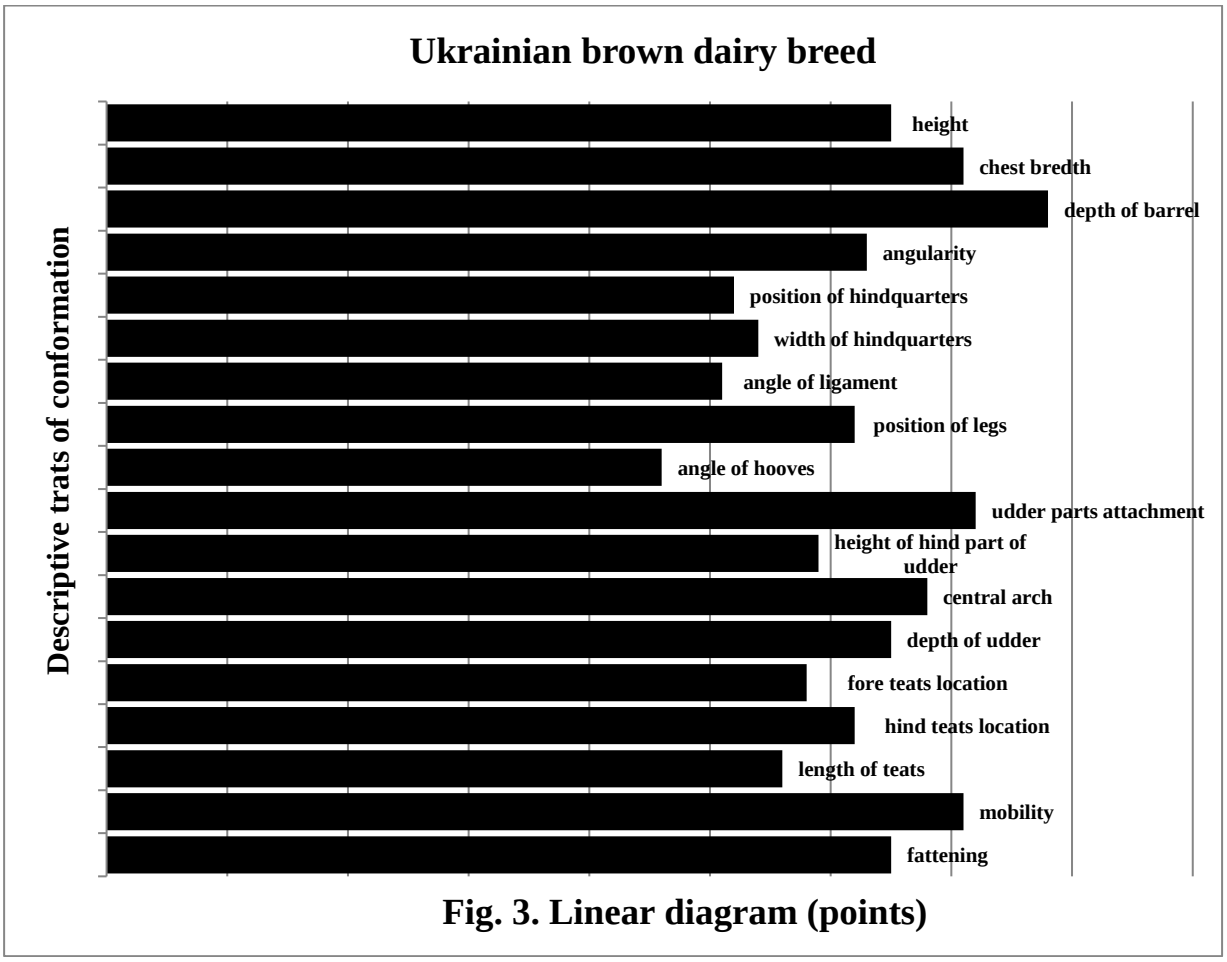

Fig. 3. Linear diagram for Ukrainian Brown Dairy Breed (points)
Source: Own calculations.

At the same time, the assessment of linear type traits characterizing the conformation of created Ukrainian Brown dairy breed indicates that it belongs to the dairy type productivity. Animals of established breed are distinguished by pronounced angularity inherent in specialized dairy breeds, strong limbs and, especially, technological udder. According to the traits of the fore udder parts attachment, central ligament, depth, teats position and length, animals of Ukrainian Brown dairy breed are approaching to those of the Brown Swiss breed. Further careful selection based on linear type traits of the conformation will only allow us to improve this created breed in the dairy type direction.

CONCLUSIONS

The results of linear assessment of Brown cows in the Sumy Oblast revealed better indicators of the conformation type in cows of the Swiss breed, which characterize it as a specialized dairy. By the traits of linear classification, the Lebedyn cattle are approaching the combined type of productivity, and the Ukrainian Brown dairy cattle occupy an intermediate place between the maternal and paternal breeds.

Indicators of linear evaluation of the type of Brown cattle cows of different origins confirmed the better development of limb traits and body development in Lebedyn cattle compared to animals of Brown Swiss and Ukrainian Brown dairy breeds. At the same time, they were inferior in the development of technological features of the udder.

Therefore, in order to improve the morphological qualities of the udder, the breeding stock of the original Brown breed of breeding have been selected for the preservation of the Lebedyn cattle, assessed by the conformation type of daughters with excellent indicators of the dairy system linear type traits.

Further scientific research, will be aimed at carefully evaluating the progeny obtained from the Lebedyn cows and the original Brown Swiss bulls, with the selection of animals of the desired type for breeding. This will preserve valuable maternal properties and improve the technological qualities of the udder.

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