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ORIGINAL ARTICLE

Productivity level of broad-bodied and narrow-bodied cattle

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We analyzed the influence of the constitution type of cows of Ukrainian black-and-white milk breed on their milk production and reproductive ability. Broad-type cows probably dominated over age equivalent of narrow-bodied type by chest-broad and loin-broad indexes by 2.75 (11.2%; P>0.001) and 1.35 (5.04%; P>0.01). The model deviation for broad-bodied and narrow-bodied cows was +8.77 and -6.32, respectively. According to the main linear measurements of the first-born of a broad-leaved type of constitution, We revealed that broad-bodied cattle dominated of their narrow-bodied age mates by the height at withers (by 0.9%), chest depth – by 7.6%, chest width – by 8.5%, loid width – by 8.7%, body length by 10.1%, girth by 3.2%, and the cannon bone circumference by 1.6%. The difference in ratio between relative decline of growth and annual of cattle with different constitutional types was revealed. The broad-bodied yearlings had higher (84.1 ± 1.89) than narrow-bodied (81.2 ± 1.43) ones. Broad-bodied yearlings exceed (P>0.05) the narrow-bodied by the milk yield and fat content - by 9.8 and 10.1% respectively. The productivity factor which is higher by 0.01 (0.9%) indicates that with increase in productivity the broad-bodied cattle had no reduction in reproductive capacity. We registered a high level of differences in the reproductive capacity between the cattle of different body types; however, the difference in living weight was insignificant and was within the range of 1.0%. The first grade cattle increase the fat contamination with milk yield growth, second-grade cattle decrease the milk fat along with yield growth, and third-grade cattle increase has a stable fat contamination. The first-grade cows considered the most valuable. Their rate among the broad-bodied is 11.8%, and 11.1 among the narrow-bodied which promotes the selection of desirable body-type cattle with high productivity and fatty values. Thus, it is obvious to select the cattle with desired constitutional type, which would combine high productive and reproductive qualities.
Keywords: Cattle; broad-bodied; narrow-bodied; milk productivity; reproductive ability

Introduction

The main task of selection in dairy cattle breeding is to increase the genetic potential of animals by main economic and useful features. Many Ukrainian authors have proved (Shcherbatyi et al., 2017, Chernenko et al., 2016, Khmelnychyi, 2007) that the expressed breed typology and exteriors indices finally determine the type of cattle constitution, its strength, which greatly affects the level of milk productivity and reproductive capacity. This issue becomes acute when using intensive resource and energy-saving milk production technologies. Under such technologies, the livestock must have well-developed cardiovascular, respiratory, digestive, endocrine, and reproductive systems, a strong constitution, high productivity, efficient use of feed, resistance to diseases that can sustain prolonged stress (Kohut et al., 2016; Dynko, 2016; Stoliar, 2014; Chernenko, 2003).

The peculiarity of the current state of development of dairy cattle breeding in Ukraine is the widespread use of the best gene pool of breeds of other countries for the improvement of local livestock and environmental safety and creating new breeds. In these conditions, it is important not to lose valuable features of local breeds, their adaptability to natural and climatic and fodder conditions, and the production of green high-quality products.

All this requires consideration the constitutional features of animals, their reaction to the conditions of the environment, since the quantity and quality of the products derived from them and, consequently, the health of people depends on it. The effectiveness of dairy cattle is determined not only by the level of milk productivity. The technological properties of milk, in particular the content of fat, protein, dry matter and other components, are essential. Therefore, the definition of qualitative composition of milk, its caloric value and the suitability for processing is very important. The current level of ecological safety in Ukraine has remained low and there is significant deterioration in the quality of milk and other types of agricultural products. Therefore, the purpose of this research is a comprehensive assessment of Ukrainian black-and-white dairy cattle by type of constitution and analysis of the influence of constitutional features on milk production and reproductive capacity.

Methods

The object of the study was the cows of the Ukrainian black-bream breed (n=65), selected by age and physiological state.

Types of animal constitution were established visually and by the method of model deviations according to Panasiuk & Karlova (2007):

$$a=\left(\frac{B}{M}-1\right)\times 100,$$

where a is a model deviation; B - index of a separate animal; M - model index (average value of the same index).

The relative decline of growth to the old age was calculated by Panasiuk & Karlova (2007):

$$K=\left[\left(\frac{Wt-W_0}{Wt+W_0}\right)\times 2-\left(\frac{Wt_1-W_0}{Wt_1+W_0}\right)\times 2\right]\times 100,$$

where K - decrease of relative growth rate (%); Wt - live weight at the age of 6 months, kg; W_0 - live weight at birth, kg; Wt_1 - live weight at the age of 12 months, kg.

The features of the cattle exteriors were determined by their measurements and body structure indices. Dairy productivity for the first lactation of animals was established by control milking using the primary farm documentation.

The qualitative composition of milk in cows of different types of constitution (n=65) was determined during the second lactation in the laboratory of the Department of Technology of Feeding and Breeding Animals of the Dnipro State Agrarian and Economic University by ultrasonic milk quality analyzer "*Milk Analyzer Ekomilk Milkana KAM 98-2A*".

To determine the impact rate of constitutional types of cows on their milk yield, we used one-factor dispersion analysis by Statistica 12.0 software (StatSoft Inc., USA).

For the estimation of the fertility of full-age cows, taking into account their productivity, we used V.P. Burkat formula (Burkat, 1982):

$$Kp=\frac{By}{(Sn:g)\times(Kg-60\times Kl)},$$

where Kp - coefficient of productive use of cows; By - actual expectations for all the days of all lactating accounted (kg); Sn - the amount of tribute for all lactation (for 305 days or reduced lactation, kg); g - the number of days; Kg - number of calendar days from the date of the first visit to the date of the last launch, Kl is the number of lactations.

To determine the influence of environmental factors on the body of cows of different types of constitution were conducted seasonally in the period from July 2018 to March 2019 by measuring the air temperature by mercury thermometer, atmospheric pressure – by barometric aneroid.

Research results are statistically processed and presented using Statistica 12.0 (StatSoft Inc., USA). The probability of differences was estimated using t-student test (P<0.05, P<0.01, P<0.001) after checking the normality of distribution and the difference between general dispersions. The values in the tables presented as the means and standard deviations.

Results

According to the measurement data of Ukrainian black-and-white dairy cattle (n=65), we identified two constitutional types - broad and narrow (Table 1).

Table 1. Body indices of cattle and model deviations.

Index	Body Type	
	Broad-bodied, n=38	Narrow-bodied, n=27
Chest broad	24.52 ± 0.13***	21.77 ± 0.10
Back broad	26.77 ± 0.22**	25.42 ± 0.15
Model deviation	+8.77 ± 1,23	−6.32 ± 0.30

Note. Significance at ** P<0.01, *** P<0.001.

The broad-bodied cows had higher indices of chest width and back width by 2.75 (11.2%; P<0.001) and 1.35 (5.04%; P<0.01). The model deviation for wide-bodied and narrow-bodied cattle was +8.77 and -6.32, respectively.

Table 2. Linear measurements of cows of different types of constitution, cm.

Parameter	Type	
	Broad-bodied, n=38	Narrow-bodied, n=27
Height at the withers	130.6 ± 1.42*	129.4 ± 2.18
Depth of breast	66.7 ± 1.74**	62.0 ± 2.43
Chest width	48.3 ± 2.57***	44.5 ± 3.26
Loid width	53.8 ± 1.83***	49.5 ± 2.46
Body length	155.7 ± 2.60***	141.4 ± 3.28
Chest girth	196.1 ± 1.72***	190.0 ± 2.49

Cannon bone circumference	19.3 ± 0.59**	19.0 ± 0.74

Note. Probability of difference: * P<0.05; ** P<0.01; *** P<0.001

According to the linear dimensions, the broad-bodied cow had higher values of height at the withers by 0.9%, the depth of the breasts by 7.6%, the width of the breasts by 8.5%, loid width by 8.7%, body length by 10.1%, chest girth by 3.2%, and cannon bone circumference by 1.6%. The change in mass during the growth of animals occurs in various patterns and depends on their hereditary features that determine the sequence of growth rates in different age periods of ontogenesis, which in turn leads to the formation of different constitutional types and productivity (Table 3).

Table 3. Intensity of the decline of cattle growth prior the one-year age.

Body type	n	Decline, %
Broad-bodied	38	84.10 ± 1.89
Narrow-bodied	27	81.20 ± 1.43
Herd average	65	82.40 ± 1.15

We detected that the coefficients of relative decline in growth were higher in individuals belonging to broad-bodied type. This indicates that they had rather elder genetic origin and are better adapted to the conditions of the environment. The stable high level of cow productivity, which is maintained during a series of lactation and has high hereditary qualities, which are consistently transmitted to offspring, greatly increases the economic efficiency of milk and dairy products production. Indicators of dairy productivity of cows of different types of constitution are presented in Table 4.

Table 4. Milk productivity of cows with different types of constitution for first lactation.

Constitution	n	Yield, kg	Fat contamination,%	Milk fat, kg
Broad-bodied	38	5098.10 ± 68.40*	3.790 ± 0.003	193.20 ± 1.770**
Narrow-bodied	27	4778.30 ± 25.210	3.780 ± 0.002	180.60 ± 1.920

Note. Probability of difference: * P<0.05; ** P<0.01

According to Table 4, the broad-bodied cows had higher milk yield by 319.8 ± 34.121 kg and a milk fat content by 12.6 ± 5.20 kg (P<0.01), which corresponds to 6.3% and 6.5% respectively. We selected three types of connection between the milk yield and fat content in the group of experimental animals of different constitutional types (Table 5).

Table 5. Milk productivity of cows of different body types and its variability towards the yield and fat content.

Type	%	Lactation	Yield		Fat contamination		Milk fat	
			kg	CV ± SD	%	CV ± SD	kg	CV ± SD
Narrow-bodied, n=27								
First, n=3	10.7	1	4663.0 ± 226.62	15.2 ± 0.78	3.72 ± 0.010	0.7 ± 0.01	173.5 ± 8.52	15.3 ± 1.02
		2	5089.0 ± 187.60	10.2 ± 0.02	3.79 ± 0.032	2.1 ± 0.03	192.9 ± 7.16	10.3 ± 0.14
		3	5372.0 ± 214.01	11.5 ± 0.17	3.81 ± 0.016	1.0 ± 0.02	204.7 ± 8.35	11.7 ± 0.78
Second, n=11	41.1	1	4877.9 ± 174.70	23.4 ± 1.01	3.90 ± 0.022	2.3 ± 0.11	190.2 ± 6.62	22.1 ± 1.90
		2	5019.8 ± 112.49	12.2 ± 034	3.83 ± 0.051	5.8 ± 0.04	192.2 ± 4.21	12.1 ± 0.87
		3	5405.6 ± 103.15	10.0 ± 0.98	3.77 ± 0.011	1.2 ± 0.07	203.8 ± 3.90	10.0 ± 0.61
Third, n=13	48.2	1	4720.7 ± 117.24	16.1 ± 1.89	3.79 ± 0.009	1.2 ± 0.04	178.9 ± 4.39	15.9 ± 1.07
		2	5025.6 ± 115.32	14.6 ± 0.11	3.79 ± 0.011	1.5 ± 0.02	190.5 ± 4.24	14.2 ± 0.15
		3	5344.4 ± 104.49	11.3 ± 0.15	3.81 ± 0.011	1.3 ± 022	203.6 ± 3.81	10.8 ± 0.04
Broad-bodied, n=38								
First, n=4	11.8	1	5170.0 ± 534.92	29.1 ± 0.054	3.78 ± 0.023	1.2 ± 0.23	195.4 ± 19.38	28.2 ± 2.21
		2	5478.0 ± 449.04	22.2 ± 1.03	3.81 ± 0.050	2.6 ± 0.13	208.7 ± 15.35	20.0 ± 1.90
		3	5882.0 ± 213.22	10.2 ± 0.66	3.82 ± 0.031	1.6 ± 0.14	224.7 ± 7.13	8.9 ± 1.21
Second,n=12	32.3	1	5017.7 ± 186.44	15.7 ± 0.08	3.86 ± 0.019	1.5 ± 0.09	193.7 ± 6.61	14.4 ± 0.06
		2	5482.0 ± 215.06	15.9 ± 0.60	3.75 ± 0.022	1.8 ± 0.07	205.6 ± 7.31	14.4 ± 0.56
		3	5769.9 ± 212.23	14.4 ± 0.54	3.75 ± 0.013	1.1 ± 0.01	216.4 ± 7.77	14.0 ± 0.34
third, n=22	55.9	1	5127.7 ± 100.48	10.5 ± 0.09	3.79.011	1.2 ± 0.11	194.3 ± 3.80	10.5 ± 1.07
		2	5579.2 ± 91.39	9.0 ± 0.67	3.79 ± 0.018	2.0 ± .44	211.5 ± 3.24	8.4 ± 0.71
		3	5849.3 ± 153.78	13.8 ± 0.56	3.78 ± 0.009	1.0 ± 0.23	221.1 ± 5.77	13.7 ± 0.65

In animals of the first type the content of fat in milk increases along with yield growth, of the second - the fat contamination decrease with yield growth, while of the third type the fat content remains at the same level.

The first type cows should be considered the most valuable animals (Table 5). The number of such animals among broad-bodied cows is 11.8% compared to narrow-bodied (11.1%). This allows selection of animals of the desirable constitutional type, which combines high productive and fat-dairy qualities.

To determine the influence percentile of constitutional types of cows on their milk productivity, we conducted a one-factor dispersion analysis (Table 6). The data show that the type of constitution of cows affects their milk productivity. Thus, body type explained the 34.78% (P<0.01) of milk yield, 13.01% of milk fat, and 2.15% of fat contamination.

Table 6. The cow body type influence proportion on their milk productivity.

Parameter	Influence proportion,%
Yield for first lactation, kg	34.78**
Fat contamination,%	2.15
Dairy fat, kg	13.01

Note. Probability of difference: ** P<0.01

When selected the new breeds an important element is the preservation and improvement of their reproductive capacity at the level of parent breeds that are directly involved in breeding. The degradation of reproductive qualities reduces the effectiveness of selection and slows down the formation of the breed. At the same time, low calving rates significantly affect the profitability of a particular farm and the whole agricultural sector (Honchar & Sotnichenko, 2015).

Assuming, that the parameters of milk productivity and reproductive ability of animals are considered almost independently at breeding, we concluded that the coefficient of productive use of cows must attain great importance. It could evaluate the fertility of cows taking into account their productivity.

We presented the indicators of reproductive capacity of cows towards the type of constitution in Table 7.

Table 7. The indicators of cow reproductive capacity on the type of constitution.

Indicator	Body type	
	Broad-bodied, n=38	Narrow-bodied, n=27
Productivity use coefficient	1.090 ± 0.013	1.080 ± 0.015
Average duration of the service period, days	110.60 ± 14.710	148.40 ± 10.310*
Average dry period, days	65.20 ± 2.80	64.30 ± 3.20
Live weight at the first insemination, kg	399.20 ± 8.350	395.80 ± 7.620

Note. Probability of the difference: * P<0.05.

According to Table 6, the broad-bodied cows had shorter average duration of the service-period by 37.8 days (25.5%; P<0.05). More higher (by 0,01 or 0.9%) productivity use coefficient shows that the productivity of broad-bodied cows was not accompanied by deterioration of reproductive capacity. There is a rather high level of differences in reproductive capacity between the cows with various body types, but the difference in living weight was insignificant and was within the range (1.0%).

Over the past decades, the livestock production in Ukraine has been implementing programs to intensify the production by cutting-edge technologies and radical changes in the genesis of local breeds of dairy cattle. Nevertheless, more attention is paid to the quality of products, its chemical composition and the ratio of milk components. Each animal has its typical metabolism, which is influenced by individual and breed characteristics, which in turn are reflected in milk productivity (Martunova & Batanov, 2004; Bondarchuk & Bondarchuk, 2002).

Our research has found that for the successful selection of breeding it is important to identify the relationship between the amount of milk production and the components of milk (fat content and protein content), as well as knowledge of the patterns of these relationships and the possibilities of their change in the desired direction. Therefore, the study of the qualitative composition of milk during lactation is of great importance for breeding improvement of Ukrainian black-and-white milk breed. To determine the qualitative composition we took the milk samples from same age cows, analogues of the second lactation of one season of calving (Table 8).

Data in Table 8 indicate that cows of both body types have surpassed the breed standard towards the yield by 43.3 and 37.2% respectively over the second lactation. We should note that the fat content and the amount of protein are among the most important features in the selection, the development of which largely depends on the economic efficiency of dairy cattle. According to this indicator, the advantage of broad- and narrow-bodied cows was 0.39 and 0.25%, respectively, towards the breed standard.

It should be underlined that the protein content exceeds 3.2% in 100.0% of experimental cows, which indicates the possibility of its increase by selection. The cows of broad- and narrow-bodied type exceeds the breed standards by the content of the total protein at 0.13% and 0.12% respectively.

However, our research has shown more higher yield in broad-bodied cows by 228.8 kg (4.2%), in which milk was more caloric (by 13.5 kcal or 2.02%) compared to narrow-bodied cows.

Table 8. Qualitative composition of milk of Ukrainian black-breasted milk breed cows of second lactation.

Parameter	Narrow-bodied (n=27)		Broad-bodied (n=38)	
	$\overline{X}$ ± SD	CV ± SD	$\overline{X}$ ± SD	CV ± SD
Yield for second lactation, kg	5215.1 ± 14.07	8.3 ± 0.54	5443.9 ± 23.56	7.2 ± 0.42
Dry substance, g	12.34 ± 0.012	2.6 ± 0.04	12.51 ± 0.015	2.3 ± 0.03
Fat content,%	3.85 ± 0.006	4.8 ± 0.11	3.99 ± 0.011	3.8 ± 0.11
Milk Solid Nonfat,%	8.49 ± 0.008	2.3 ± 0.22	8.52 ± 0.010	2.2 ± 0.22
Total protein content,%	3.32 ± 0.004	2.5 ± 0.02	3.33 ± 0.005	2.6 ± 0.03
Lactose,%	4.46 ± 0.005	2.4 ± 0.01	4.48 ± 0.008	2.5 ± 0.02
Ash,%	0.71 ± 0.018	2.5 ± 0.02	0.71 ± 0.023	2.2 ± 0.03
Density, °A	27.29 ± 0.030	2.2 ± 0.03	27.79 ± 0.038	2.4 ± 0.04
Acidity, °T	17.80 ± 0.014	2.1 ± 0.06	17.83 ± 0.021	1.9 ± 0.06
Calorie content per 1 kg of milk, kcal	654.45 ± 0.793	2.2 ± 0.21	667.95 ± 0.931	2.5 ± 0.23

There is a positive correlation in the herd between the yield and fat content in milk (r=0.16); between the yield and amount of milk fat (r=0.78); between the fat content of milk and the amount of milk fat (r=0.33). It can be argued that the findings indicate a large amount of unused genetic potential in cows to increase the amount of fat and the amount of protein in milk by intra-breeding selection. However, the manifestation of this genetic potential may be constrained by unsatisfactory environmental factors, and the existing breeding practice. This not fully use the selection for genetic improvement of the herd on the amount of fat and the amount of protein in the milk. It is established that the qualitative composition of milk, and accordingly, and its nutritional value varies depending on the season of the year. To determine the influence of natural factors on the indicators of the main components of milk, we studied the qualitative milk composition of cows of different body types towards season of the year (Table 9).

The results of seasonal variability in the qualitative composition of milk (Table 9) indicate that, regardless of the constitutional type, in all the seasons it was high quality and suitable for use in dairy processing enterprises. Commodity milk complies with the requirements of the state standard DSTU 3662: 2015 "Milk-raw cow's milk. Specifications" and in accordance with EC Regulation No 853/2004 of the European Parliament and Council on 29 April of 2004 prescribed the specific hygiene rules for the foodstuffs. The pronounced seasonal changes occurred between the main components of milk. Thus, the highest amount of dry matter, the content of fat and minerals in milk was observed in the winter, and the lowest - in spring. This, in our opinion, should be associated with a decrease in the spring feed value and a change in the cow metabolism, namely spring mold, during which a large part of the nutrients is used for growth and restoration of the hair. The lactic acid bacteria hardly develop in spring milk and the energy of their acid formation is reduced. Winter milk was the most caloric (661.9 and 686.9 kcal, respectively).

Seasonal variability of lactose is more pronounced than fat and protein. The variation of this component in milk was in the range of 4.46-4.51%, and its level was the highest in the summer (4.48 and 4.51% in narrow and broad-bodied cows). As for the total protein, the amplitude of oscillation was less significant and amounted to 3.30-3.35%. The highest level of this indicator in milk was registered in autumn (3.34 and 3.35% respectively) and the lowest in winter (3.30 and 3.31%).

Table 9. Seasonal qualitative composition of milk of Ukrainian black-breasted milk breed cows of second lactation.

Parameter	Season			
	Winter	Spring	Summer	Autumn
Narrow-bodied, n=27				
Dry substance, g	12.43 ± 1.221	12.29 ± 1.34	12.27 ± 1.43	12.38 ± 1.49
Fat content,%	3.92 ± 0.073	3.81 ± 0.084	3.79 ± 0.092	3.88 ± 0.108
Milk Solid Nonfat,%	8.47 ± 0.211	8.48 ± 0.315	8.50 ± 0.411	8.52 ± 0.428
Total protein content,%	3.30 ± 0.030	3.32 ± 0.041	3.32 ± 0.046	3.34 ± 0.052
Lactose,%	4.46 ± 0.052	4.46 ± 0.063	4.48 ± 0.072	4.47 ± 0.081
Ash,%	0.71 ± 0.022	0.70 ± 0.031	0.70 ± 0.038	0.71 ± 0.045
Density, °A	27.51 ± 0.104	27.23 ± 0.111	27.02 ± 0.117	27.41 ± 0.124
Acidity, °T	18.1 ± 0.058	17.5 ± 0.062	17.7 ± 0.069	17.9 ± 0.072
Calorie content per 1 kg of milk, kcal	661.9 ± 1.03	650.6 ± 1.19	648.0 ± 1.21	657.3 ± 1.35
Broad-bodied, n=38				
Dry substance, g	12.75 ± 1.296	12.44 ± 1.342	12.35 ± 1.438	12.50 ± 1.651
Fat content,%	4.18 ± 0.082	3.93 ± 0.107	3.86 ± 0.129	3.98 ± 0.143
Milk Solid Nonfat,%	8.50 ± 0.288	8.51 ± 0.312	8.55 ± 0.413	8.53 ± 0.519
Total protein content,%	3.31 ± 0.036	3.33 ± 0.051	3.34 ± 0.069	3.35 ± 0.079
Lactose,%	4.48 ± 0.068	4.47 ± 0.079	4.51 ± 0.083	4.47 ± 0.094
Ash,%	0.71 ± 0.019	0.71 ± 0.043	0.70 ± 0.057	0.71 ± 0.067
Density, °A	28.12 ± 0.148	27.60 ± 0.227	27.52 ± 0.384	27.93 ± 0.412

Acidity, °T	18.1 ± 0.072	17.3 ± 0.091	18.0 ± 0.128	17.9 ± 0.144
Calorie content per 1 kg of milk, kcal	686.9 ± 1.56	662.4 ± 1.67	655.0 ± 1.79	667.5 ± 1.83

The change for milk solid nonfat during the year was the most significant in cows of both types of constitution and amounted to 8.47-8.55%. Such changes correspond to the physiological state of cows (second triens of the lactation period) and are caused by the age diet of feeding.

Borsch et al. (2017) in their studies point to the direct influence of weather factors on animal productivity, which is carried out through the hypothalamus. The hypothalamus receives information on climatic conditions in two ways: through the receptors of the skin, which transfer the signal to the central nervous system and due to changes in the temperature of blood entering the hypothalamus from the body. The negative effect of weather affects the general condition of animals, namely the decrease in appetite, and as a result, a decrease for feed consumed. As a result, the body gets less material for the synthesis of livestock products. Therefore, we also took into account the air temperature and atmospheric pressure during the research (Table 10).

Table 10. Seasonal distribution of air temperature and atmospheric pressure.

Season	Air temperature, °C	Atmospheric pressure, GPa
Winter	+ 12.5	1013.9
Spring	+ 18.1	1015.1
Summer	+ 28.4	1023.3
Autumn	+ 16.3	1018.8

Table 10 indicate that the temperature of the air, except for the summer period, was within the thermo-neutral level (comfort temperature). The amount of atmospheric pressure corresponded to the established zoo-hygienic standards and the fluctuations were insignificant and related to changes in weather conditions and the season of the year. Thus, the level of milk productivity and qualitative composition of milk characterize not only the breeding value of animals, but also their adaptive ability to local conditions. Comprehensive study and consideration of favorable and unfavorable environmental factors that influence the synthesis of the components of milk make it possible to significantly improve the effectiveness of selection and change it in the proper direction.

Discussion

The peculiarity of the current state of development of dairy cattle breeding in Ukraine is the widespread use of the best gene pool of breeds of other countries for the improvement of local livestock. The impact of environmental factors on the health of animals and humans, the quality of food is now one of the topical scientific issues. Indeed, every inhabitant of Ukraine faces about of 150 kg of toxic substances that pollute the air, almost 100 m^3 of wastewater entering the reservoir and 500 tons of accumulated solid waste. As a result, the number of deaths exceeds the number of births since 1991 in Ukraine. The dynamics of the annual decline in population reached 0.6% (Kyrlayk et al., 2006). In these conditions, it is important not to lose valuable features of local breeds, their adaptability to natural and climatic and fodder conditions.

In this regard, more requirements are put forward to animals. They must be adapted to eating a large amount of feed, ensuring high productivity, be suitable for machine milking, have high reproductive capacity, resistant to diseases, and have a strong constitution. Practice shows that some animals quickly adapt to new conditions, the other is slower, or does not adapt at all, which causes the annual premature release of 30.0% of the breeding stock. The selection rate towards the desired direction depends largely on the proportion of constitutional types in each particular herd. Our studies proved that the broad–bodied cows prevailed (58.5 vs. 41.5%) over the narrow-bodied. Thus, our data do not coincide with results of Lesnovskaya O.V. (2019), Honchar O.F. (Honchar & Sotnichenko, 2015), Panasiuk, Karlova (2007), however, the difference was insignificant according to in their relative weight.

The broad-bodied cows had higher values of chest-broad and tail-broad indices - 2.75 (11.2%; P>0.001) and 1.35 (5.04%; P>0.01) respectively, than narrow-bodied ones.

Analyzing the indicators of dairy productivity of cows of different types of constitution, we can conclude that individuals of broad-bodied type are more productive. Izrailov F. (Fedak et al., 2018; Izrailov, 1986) reports that the daily yield of broad-bodied Red Steppe cows were greater by 1.1 kg (10.1%), Swedish - by 1.73 kg (19.6%) compared to narrow-bodied cows. The average speed of lactation performance was the highest in both breeds of broad-bodied type (1.476 kg min^{-1} and 1.246 kg min^{-1} than in the narrow-bodied type (1.324 kg min^{-1} and 1.112 kg min^{-1}).

The highest yield for 305 days of the completed first lactation were obtained from cows of broad-bodied, delicately loose type (8091 kg). Among the cows of the narrow-bodied type, the highest yield was registered in dry-dense cows (7990 kg). These data are fully consistent with our research findings.

A greater (by 0.01 or 0.9%) productive use rate indicates that productivity in broad-bodied cows is not accompanied by a deterioration in reproductive capacity. Other researchers (Chernenko et al., 2016; Lamonov & Pogodaev, 2004; Chernenko, 2003; Shalimov, 1986) confirmed similar data.

It was established (Barabash et al., 2002) that in cows of broad-bodied, delicately-loose type has the yield of calves by 7.2% higher than cows of narrow-bodied, whipped, tender-brittle and rude-brittle constitutional types. The lowest yield of calves

was registered in cows of broad-bodied dry-dense type (58.9%), which was 17.6% less than in the same cows with narrow-bodied type.

According to Tsiupko V.V. (Tsiupko, & Tsiupko, 2012), the most significant differences in milk caused by winter and summer fat diet. The fat content of milk in summer rations may decrease because of changing the character of fermentation in the pre-corses. In summer rations, rich in soluble carbohydrates, the content of ketogenic acetate and butyrate decreases and the amount of propionic acid is increased. Reducing the production of acetate and butyrate, as the major precursors to the synthesis of fatty acids, is responsible for lowering the fat content of milk in the summer. The content of protein and fat in milk naturally increases until the end of lactation, and the content of lactose is reduced. Thus, there is an increased lactose synthesis in the midst or during the dominant lactation, and the lactose synthesis is reduced at the end of lactation, before the start. Consequently, the state of the dispersed medium changes during lactation, providing favorable conditions for the existence of the whole polydisperse system, which is milk.

It has been established that the concentration of fat and protein in milk is naturally reduced with increasing of the yield, and the content of lactose increases. The most important is the dynamics of lactose content. These changes range from 4.79 to 5.05% and do not significantly affect the quality of milk (Prischedko et al., 2017, Karlova, 2016).

According to Schapovalov & Al-Basi Mesher Kamil (2012), the protein content of milk is significantly influenced by the breeds. Under similar conditions, keeping and feeding the cows of the Ukrainian black-and-white milk breed dominated the Simmental's elders, both in terms of diet and protein content during the lactation period.

Borsch O.O. et al. (2017) reported the results of studies on the influence of ambient temperature in the thermo-neutral period and in the period of low-temperature load on productivity, daily behavior and bioenergetics of Ukrainian red-and-rumped breed cows under different yard housing: in cubicle systems and on a deep litter in easily assemblage constructions.

The cows responded with a decrease in productivity towards change the temperature in both variants of yard housing - by 10.86% (3.55 kg) in cubicle systems and 5.65% (1.82 kg) for deep litter. At the same time, the mass fraction of fat in the milk increased by 0.09 and 0.08%, respectively, during this period. During the low-temperatures the cows spent less time for feeding, drinking, and walking, but spent more time for resting and lying, compared to the thermoneutral period in both variants of yard housing. In general, in both temperature periods, the duration of the basic acts of behavior corresponded to physiological norms. Reducing the feeding time during the temperature load resulted in a decrease of the number of feed responses and the duration of gum in cows in both variants of yard housing.

It has been established that the low temperature (-11.1 °C and below) becomes a stress factor for cows in the conditions of free-stall housing with easily assemblage constructions and causes a recession of feed activity - the duration of consumption of feed and cud and, as a consequence, a decrease in productivity. At the same time, the duration of rest in a lying position increased by 58 minutes for cubicle system and by 41 minutes for deep litter.

Milostiviy et al. (2017) and Karlova & Lesnovska (2017) noted that the level of milk production, the qualitative composition of milk, and the adaptive capacity of the Holstein breed cows depend on the origin and linearity of the animals. It was found that the average daily nutrition of Cows of Danish, Germanic and Hungarian origin exceeded the requirements of the breed standard by 7.9, 6.9, and 8.8 kg or 32.5, 29.7, and 35.1%. Their daughters exceeded the breed standard by 9.2, 8.8, and 11.1 kg, or 36.1, 36.0, and 40.5% respectively. Only the Danish and German breeding animals and their descendants had relevant fat content regards the standard breed (3.6%). The obtained data allow conducting selection and breeding work in the direction of improving the desirable features.

According to Karlova et al. (2018), the state of the organism's response to environmental factors affects the livestock performance of animals and the qualitative parameters of milk.

Conclusions

The productive and reproductive qualities of cows caused by their constitutional features. For further breeding, we suggest to select animals that would combine a broad-bodied constitution and high milk productivity.

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