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COMPARATIVE CHARACTERISTICS OF EXTERIOR AND ECONOMICALLY USEFUL FEATURES OF DAUGHTERS OF DIFFERENT BULLS

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Abstract

There are presented the results of studies of the exterior and economically useful characteristics of first calf heifers of the local generation of the Holstein breed, bred in a herd of Joint-Stock Company "Aydyn", Komrat, Administrative and Territorial Unit Gagauzia, Republic of Moldova. The bone index in comparison with the standard turned out to be on average 8.3% lower, which is due to the high height at the withers of Holstein cows. Comparative analysis of milk productivity of daughters of various bulls showed that milk yield for 305 days of lactation of daughters of bull Forms 999 is 155 kg more milk than that of daughters of bull Kiperush 79. Realization of the genetic potential of first-calf heifers of local selection was at the level of 91.4-92.1% of the productivity of full-aged cows, with a fat content of 3.82-3.89%. The relationship between the milk yield and the percentage of fat in the milk of the daughters of the analyzed bulls was in a positive correlation from the weak (+0.034, daughter of Kiperush 79), to moderate (+0.369, daughter of Forms 999).

Key words*: body builds indices, correlation, exterior, first-calf heifer, milk yield.*

INTRODUCTION

Cattle breeding are one of the leading industries in Animal Science, which determines the wide distribution of cattle in various natural and economic zones of the world. The exterior or the appearance of an animal is formed under the influence of the genotype and living conditions of the organism. The combined action of these two factors is carried out in the process of individual development of animals.

Examination of the exterior allows determining the relationship that exists between the appearance of the animal and its productivity. The correct physique and strong constitution may indicate the resistance of animals to adverse external influences, the ability to long-term economic use.

When breeding for the milk production of cows, individual populations of cattle, evaluation of the exterior of animals is of no small importance, the features of which have a certain connection with the duration of the productive use of highly productive cows (Ovchinnikova et al., 2016; Babich et al., 2018; Kostomakhin et al., 2011).

As the exterior is closely related to milk productivity, in the selection of the exterior on animals, takes place an indirect selection and productivity. Exterior assessment includes as the general appearance of the animal (typicality, manifest of dairy forms, presence of defects and deficiencies) as specific measurements of individual parts of the animal's body, anatomically related to each other.

For the last 10 years, Holstein cattle have been imported to the Republic of Moldova from such European countries as Holland, Germany, France, Austria and Hungary. These animals are distinguished by increased productivity, good health and are able to acclimatize and adapt to the conditions of various climatic zones of the republic.

Research has been carried out and studied the milk productivity (first – fourth lactation) and the exterior of Holstein cows of Dutch and German breeding for the first and third lactations in the herd of Joint-Stock Company

"Aydyn", (Foksha et al., 2016; Foksha et al., 2019). It has been established that under the new housing conditions, Dutch and German Holstein cows realize their genetic potential at a high level (Konstandoglo et al., 2018; Foksha et al., 2018), which is facilitated by the appropriate conditions of housing and feeding of animals. It should be noted that the Holstein cattle, purchased from Holland and Germany, successfully adapted to the conditions of the south of the Republic of Moldova, in particular in herds of Joint-Stock Company "Aydyn" and Society of limited liability "Doksancom".

The purpose of our research is to study the exterior and economically useful characteristics of first-calf cows of the local generation of the Holstein breed, the descendants of different sire bulls.

MATERIALS AND METHODS

The material for research were first-calf cows of the local generation of the Holstein breed of the Joint-Stock Company "Aydyn", Komrat, Administrative and Territorial Unit Gagauzia, Republic of Moldova. First-calf cows are descendants of two breeding bulls: Form 999 (n = 14), Kiperush 79 (n = 11).

Exterior-constitutional features of first-calf cows were studied by taking measurements and calculating their constitution indices. The measurements of animals were carried out on 2-3 months after calving (Basovsky, 1983; Belozertsova, 2011). Body build indices were calculated according to the generally accepted method (Kostomakhin et al., 2007). The belonging of first-calf cows to different bulls was determined on the basis of analysis of the genealogical structure of the herd, using breeding certificates, breeding cards, artificial insemination logs and other documents of primary zootechnical registration. To study the productivity of cows, the data of primary zootechnical and breeding records were analyzed. Milk yield per lactation (305 days) was calculated on the basis of control milking.

The milk yield coefficient of cows was determined by the formula proposed by Startsev (1965): MC = MY/LW, where: MC - milk yield coefficient, kg; MY - milk yield for 305 days or shortened lactation, kg; LW - live weight, kg. The genetic potential of productivity of first-calf heifers was determined on the basis of the parental index of cows (PIC) according to the formula: PIC = (2M + MM + MF): 4, where: M - mother's productivity; MF is the productivity of the father's mother; MM is the mother's mother productivity. The realization of the genetic potential (RGP) was determined by the formula: RGP = actual productivity / expected productivity according to PIC x100%, where PIC - of the parental index of cows.

The relationship was determined between all indicators of the assessment of the conformation and milk production of first-calf cows by calculating the correlation coefficient (r).

Statical processing of research materials was carried out according to the methods of Plohinsky (1978), Merkuryev & Shangin-Berezovsky (1983). The data obtained in the course of the research were processed biometrically on a personal computer using Microsoft Excel programs; the reliability of the indicators was determined by Student.

RESULTS AND DISCUSSIONS

The exterior assessment of animals is an important component in a comprehensive breeding system. The results of studying the exterior of first-calf heifers of the local generation of the Holstein breed, the descendants of bulls Form 999, Kiperush 79, are presented in Table 1.

A comparative assessment of the exterior of first-calf heifers, descendants of bulls Form and Kiperush 79 showed that in some measurements the superiority between them was insignificant. On average for the sample, the height at the withers was 144.0 cm, the height at the croup was 148.5 cm, the oblique length of the body was 160.4 cm, the chest circumference was 197.5 cm, the width at the shoulder was 47.8 cm, pastern girth - 19.3 cm.

All evaluated first-calf heifers displayed a type characteristic for Holstein cattle, which is confirmed by the index assessment of their physique (Table 2, Figure 1).

It should be noted that the body in length was better developed at first-calf cows - the descendants of the bull Kiperush 79 - in terms of the index of elongation, they exceeded their peers by 1.0%.

Table 1. Exterior of first-calf cows of local generation of offspring of various bulls (X ± Sx)

Indices	Bull's daughters		Total, n = 41
	Form 999, n = 22	Kiperush 79, n = 15	
Height at withers	144.1 ± 0.9	143.6 ± 1.1	144.0 ± 0.6
Height at the croup	148.2 ± 0.9	149.0 ± 1.2	148.5 ± 0.7
Chest depth	74.7 ± 0.7	73.7 ± 0.9	74.3 ± 0.5
Chest width	42.4 ± 0.7	41.3 ± 0.9	41.9 ± 0.5
The width of the croup at the hips	48.0 ± 0.5	47.7 ± 0.74	47.8 ± 0.4
The width of the croup at the coxo-femoral joint	29.7 ± 0.4	29.4 ± 0.6	29.7 ± 0.3
Oblique length of the trunk	160.9 ± 1.5	160.7 ± 1.9	160.4 ± 1.1
Chest girth	198.7 ± 1.5	196.5 ± 1.7	197.5 ± 1.0
Pastern girth	19.3 ± 0.2	19.3 ± 0.2	19.3 ± 0.1

Table 2. Physique indices of daughters of bulls Form 999 and Kiperush 79

Indices	Form 999	Kiperush 79	Total	Dairy productivity direction (standard)
High-legged	48.2	48.7	48.4	46.5
Elongation	111.6	111.9	111.4	120.0
Pelvic breast	88.3	86.6	87.6	80.2
Breast	56.8	56.0	56.4	61.8
Consistency	123.5	122.3	123.1	118.0
Outgrown	102.8	103.7	103.1	107.0
Bone	13.4	13.4	13.4	14.6

Figure 1. First-calf heifers of the local generation of Holstein breed

In terms of pelvic and thoracic indices, the descendants of the Form 999 bull surpass their peers - the descendants of Kiperush 79, respectively, by 1.9 and 1.4%, the difference is not significant. The obtained index values were also compared with the milk-type standard. The value of the high-leg index for first-calf cows was on average 3.9% higher, and the breast index - 8.7% less than the standard for dairy cows. The obtained values of the overgrowth index indicate a flat topline at all analyzed animals. The bone index in comparison with the standard turned out to be on average 8.3% lower, which is due to the high height at the withers of Holstein cows.

It follows from the above data that first-calf cows, on average, have a relatively better development of the chest in depth, respectively, of the chest organs. Consequently, more developed chest organs provide a higher metabolism, which leads to higher milk production. This is confirmed by the analysis of the level of milk production for the completed first lactation (305 days) of first-calf heifers of the local generation - the descendants of bulls Form 999, Kiperush 79 (Table 3).

Table 3. Milk productivity of first-calf heifers of local generation - daughters of various bulls for the first lactation, (X ± Sx)

Daughters of a Bull	Number of cows, n	Milk yield		Fat		Live weight, kg	MC*, kg
		average per day, kg	for 305 days of lactation, кg	mass fraction, %	amount of milk, кg		
Kiperush 79	11	28 ± 0.4	8379 ± 118	3.87 ± 0.03	316 ± 7.5	595 ± 4.5	1409 ± 20.5
Form 999	14	28 ± 0.4	8534 ± 127	3.87 ± 0.03	330 ± 6.2	588 ± 3.4	1448 ± 21.9

MC* - of milk produced per 100 kg of live weight

As it can be seen from the materials in Table 3, the evaluated heifers exceeded the standard for milk yield and other indicators for animals of the Holstein breed. So, the milk yields of the daughters of the bull Kiperush 79 were 579 kg and of the daughters of the Form 999 bull - 734 kg of milk more than the breed standard. The fat mass fraction of the daughters of both bulls was by 0.27% higher than the breed standard. In terms of the amount of milk fat, the excess was 35 kg (daughter of Kiperush 79) and 49 kg (daughter of Form), the breed standard was 281 kg. A comparative analysis of the milk productivity of daughters of various breeding bulls showed that milk yield for 305 days of lactation at the daughters of the bull Form 999 is 155 kg more milk than at the daughters of the Kiperush 79 bull, the difference is not significant.

By live weight, first-calf heifers exceeded the breed standard (550 kg) by 45 and 38 kg, respectively, for daughters of Kiperush 79 and Form 999. The calculated milk production coefficient showed that for the daughters of both analyzed bulls, it exceeded the norm. Its value close to 1000 is considered normal. The daughters of the bull Form have the highest milk production coefficient - 1448 ± 20.5 kg of milk, slightly less - 1409 ± 21.9 kg - for the daughter of the bull Kiperush 79.

Analysis of selection and genetic parameters of economically useful traits of daughters from different bulls showed that the greatest coefficient of variability on average daily milk yield and milk yield per lactation was at daughters of Form 999, which is by 20.4 and 17.6 percent more, respectively, than at daughters of Kiperush 79 (Table 4).

Coefficient of variability on indices of content and amount of fat was higher at daughters of Kiperush 79 by 3.4 and 9.8 percent, respectively. Daughters of bull Form 999 had the greatest variability in average daily milk yield and milk yield per lactation, and daughters of bull Kiperush 79 had the greatest variability in content and amount of milk fat.

Table 4. Coefficient of variability of indicators of milk productivity (Cv, %)

Daughters	Average daily milk yield	Milk yield	Fat content	Fat amount
Kiperush 79	4.3	4.2	2.9	7.1
Form 999	5.4	5.1	2.8	6.4

Coefficients of milk yield variability are lower on average by 10-25%, fat content - 2.1-4.1%, milk fat - 11-25% than according to literature data. Thus, the descendants of bulls Form 999 and Kiperush 79, local generation cows, are more homogeneous with a reduced genetic diversity.

It was calculated the realization of the genetic potential in materials and methods of first-calf heifers of local breeding, whose mothers belonged to Dutch and German breeding (Table 5).

Table 5. Realization of the genetic potential of first-calf heifers of local breeding of various origins

Indicators		Dutch	German
Own productivity	milk yield, kg	8372±69,5	8479±98,8
	fat, %	3,82±0,02	3,84±0,03
Realization of genetic potential (RGP), %)	milk yield	91,4	92,1
	fat	94,1	97,9

Realization of the genetic potential of first-calf heifers of local breeding was at the level of 91.4-92.1% of the productivity of full-aged cows, with a content of fat of 3.82-3.89%, which is consistent with the results of data on Holstein cows of German breeding - milk yield of first-calf heifers was 90, 3% of the productivity of adult animals, with a content of fat of 3.95%, (GGI-Spermex. Uber Holstein. Population; Holstein Association USA, Inc)

For a more complete study of the nature of the relationship between milk productivity at cows of local breeding of the offspring of various bulls according to the 1st lactation, was done a study of the presence of a correlation between the milk yield, fat content in milk, live weight and measurements.

Table 6 shows the results of the correlation between the build of the exterior of cows for the first complete lactation with milk yield.

Table 6. Coefficients of interrelation of milk yield for 305 days of lactation - measurements of cows of local breeding, $r \pm m_r$

Correlated trait	Daughters	
	Kiperush 79	Form 999
Milk yield - height at withers	-0.143 ± 0.33	-0.217 ± 0.28
Milk yield - height at the sacrum	0.022 ± 0.33	-0.118 ± 0.27
Milk yield - chest depth	-0.318 ± 0.32	-0.501 ± 0.25
Milk yield - chest width behind shoulder blades	0.016 ± 0.33	-0.427 ± 0.26
Milk yield - width in hook bone	-0.145 ± 0.33	**0.462 ± 0.25**
Milk yield - width at ischial tubercles	-0.186 ± 0.33	0.032 ± 0.29
Milk yield - oblique body length	0.117 ± 0.33	-0.025 ± 0.29
Milk yield - chest girth behind shoulder blades	-0.176 ± 0.33	-0.207 ± 0.28
Milk yield - pastern girth	**0.324 ± 0.31**	-0.313 ± 0.27

It was found that the nature of the correlation of milk productivity with body measurements at daughters from different bulls has different meanings and the closeness of the relationship. Thus, the daughters of the bull Form 999 showed a moderate positive relationship between milk yield and width in hook bone (r = + 0.462). A weak negative relationship was found between milk yield and height measurements - height at the withers (r = - 0.217), height at the sacrum (r = - 0.118), as well as the girth of the chest behind the shoulder blades (r = - 0.207). A moderate negative relationship was established between the measurements of the depth of the chest and the width of the chest behind the shoulder blades - 0.501 and 0.427, respectively. A moderate positive relationship between milk yield and pastern girth (r = + 0.324) was found at the daughters of the bull Kiperush 79. However, according to the majority of measurements at the daughters of Kiperush 79, a weak negative correlation is observed: between milk yield and height at the withers (r = - 0.143), milk yield and width in hook bone (r = - 0.145), milk yield in the ischial tubercles (r = -0.186), chest girth behind shoulder blades (r = - 0.176).

The daughters of both analyzed bulls showed a positive moderate relationship between fat content and breast depth - +0.418 (Kiperush 79), - +0.451 (Form 999) (Table 7).

Table 7. Coefficients of the relationship between fat content and measurements of cows of local breeding, $r \pm m_r$

Correlated trait	Daughters	
	Kiperush 79	Form 999
fat content - height at withers	0.140 ± 0.33	0.051 ± 0.29
fat content - sacrum height	-0.117 ± 0.33	-0.031 ± 0.29
fat content - breast depth	**0.418 ± 0.30**	**0.451 ± 0.26**
fat content - width of the chest behind the shoulder blades	-0.088 ± 0.33	0.144 ± 0.28
fat content - width in hook bone	-0.251 ± 0.32	**0.360 ± 0.27**
fat content - width at tubercles	-0.429 ± 0.30	0.060 ± 0.29
fat content - oblique body length	**0.538 ± 0.28**	**0.170 ± 0.28**
fat content - chest girth behind the shoulder blades	0.159 ± 0.32	-0.049 ± 0.29
fat content - pastern girth	-0.435 ± 0.30	0.113 ± 0.28

Noteworthy is a noticeable positive relationship between the milk fat content and oblique body length in the daughters of the bull Kiperush 79 (r = + 0.538), as well as a moderate positive relationship between the fat content and the width in hook bone at the daughters of the Form 999 bull (r = + 0.360). For other measurements, there is a slight positive or weak negative relationship -0.031 (height at the sacrum) - for the daughter of the bull Form 999 to a moderate relationship -0.429 (width at the ischial tubercles) and -0.435 (pastern girth) - for the daughter of the bull Kiperush 79.

A weak negative correlation was revealed between live weight and height at the withers (r = -0.072), live weight - width in hook bone (r = -0.266) at the daughters of bull Form 999 (Table 8).

Table 8. Coefficients of the relationship between live weight and measurements of cows of local breeding, $r \pm m_r$

Correlated trait	Daughters	
	Kiperush 79	Form 999
Live weight - height at withers	0.369 ± 0.31	-0.072 ± 0.29
Live weight - - sacrum height	**0.533 ± 0.28**	0.071 ± 0.29
Live weight - chest depth	-0.017 ± 0.33	0.034 ± 0.29
Live weight - chest width behind shoulder blades	0.246 ± 0.32	0.360 ± 0.27
Live weight - width in hook bone	0.492 ± 0.29	-0.266 ± 0.28
Live weight - width at tubercles	**0.758** ± 0.22**	**-0.793** ± 0.17***
Live weight - oblique body length	-0.364 ± 0.31	0.307 ± 0.27
Live weight - chest girth behind shoulder blades	0.077 ± 0.33	0.244 ± 0.28
Live Weight - pastern girth	0.427 ± 0.30	0.174 ± 0.28

Note: ** P <0.01; *** P <0.001

The value of the correlation between live weight and width at tubercles for the daughters of both analyzed bulls is high, however, the direction is different. So, for the daughters of the bull Kiperush 79, the relationship is positive - +0.758, for the daughters of the bull Form 999 - negative -0.793. The correlation coefficient "live weight - width at tubercles" is significant, at P<0.01 (daughter of Kiperush 79) and P<0.001 (daughter of Form).

Between the live weight and the height at the withers, width in hook bone and the girth of the pastern at the daughters of the bull Kiperush 79, the tightness of the connection is moderately positive and is +0.369, +0.492 and +0.427, respectively. At the daughters of the bull Form 999, the correlation between body weight and height at the withers, as well as the width in hook bone, is weak negative, respectively -0.072 - -0.266.

Thus, at daughters of Kiperush 79 and Form 999 have a moderate positive relationship between fat content and chest depth and oblique body length. It is noted a high multidirectional relationship between body weight and width in the ischial tubercles of daughters Kiperush 79 and Form 999.

It is known that the variability of the content and amount of fat in milk, as well as the live weight, depend on the variability of the milk yield of cows for lactation (Ivanova, 2018). The results of the study of the correlation between the performance indicators of daughters Kiperush 79 and Form 999 are shown in Table 9.

The relationship between milk yield and the percentage of fat in the milk of the daughters of the analyzed bulls was in a positive correlation from weak (+0.034, daughter of Kiperush 79) to moderate (+0.369, daughter of Form 999), which indicates the simultaneous selection for milk yield and fat content in milk.

Table 9. Correlation between indicators of milk productivity and live weight of cows of local breeding according to the 1st completed lactation, r ± m

Correlated trait	Daughters	
	Kiperush 79	Form 999
Milk yield - fat content	+0.034±0.33	+0.369±0.27
Milk yield - amount of fat	+0.373±0.31	**+0.935±0.10****
Milk - live weight	+0.188±0.33	-0.087±0.29

Note: *** P<0.001

It should be noted that there is a high correlation between the characteristics of milk yield - the amount of milk fat at the daughters of the bull Form 999 (+0.935) at (P<0.001), moderate - at the daughters of the bull Kiperush 79 (+0.373). A weak positive relationship was found between live weight and milk productivity at the daughters of the bull Kiperush 79 (+0.188), a weak negative (-0.087) - at the daughters of the bull Form 999. Low correlation coefficients between milk yield and live weight indicate a non-linear nature of the relationship between them, characterizes the homogeneity of the daughters of different bulls by live weight.

Thus, the correlation coefficients between milk yield and live weight (positive - daughters of bull Kiperush 79) and (negative - daughters of bull Form 999) indicate a non-linear nature of the relationships between them, and characterize the homogeneity of cows of the local generation of the herd of JSC "Aydyn" by live weight. Consequently, the revealed correlations between the studied traits make it possible to select cows according to their

exterior indicators, which contribute to an increase in milk productivity.

CONCLUSIONS

1. The body in length was better developed in first-calf cows - the descendants of the bull Kiperush 79 - in terms of the index of elongation, they exceeded their peers by 1.0%.
2. The obtained values of the overgrowth index indicate a flat topline in all the compared offspring of bulls of Forms 999 and Kiperush. 79. The bone index in comparison with the standard was on average by 8.3% lower, which is due to the high height at the withers of Holstein cows.
3. Daughters of bull Form 999 had the greatest variability in average daily milk yield and milk yield per lactation, and daughters of bull Kiperush 79 had the greatest variability in content and amount of milk fat.
4. Realization of the genetic potential of first-calf heifers of local selection was at the level of 91.4-92.1% of the productivity of full-aged cows.
5. The daughters of both analyzed bulls showed a positive moderate relationship between fat content and breast depth - +0.418 (Kiperush 79), - +0.451 (Form 999).
6. The correlation coefficients between milk yield and live weight - positive for daughters of bull Kiperush 79 and negative for daughters of bull Form 999, indicate a non-linear nature of the relationships between them, and characterize the homogeneity of cows of the local generation of the herd of JSC "Aydyn" by live weight.

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