

THE RELATIONSHIP BETWEEN HOLSTEIN COWS EXTERIOR AND DAIRY PRODUCTIVITY BY VARIOUS BREEDING

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Abstract

The article presents the results of studies of the relationship between measurements and milk production at Holstein cows of German and Dutch breeding in a herd of Joint-Stock Company „Aydyn”, Comrat, Administrative and Territorial Unit Gagauzia, Republic of Moldova. By the level of milk productivity, the cows of German breeding were significantly superior to cows of Dutch breeding by 507 kg of milk (II lactation, $P < 0.05$) and 1529 kg of milk (III lactation, $P < 0.001$), respectively. At cows of the Dutch breeding by the size of the milk yield and the connection with the measurements, dependence was found from the slightly negative -0.008 (metacarpus girth) to a high positive $+0.665$ (width in jobbers). The average milk yield relationship was established at cows of German breeding with a chest girth behind the shoulder blades ($+0.364$) and a width of a croup ($+0.336$), which indicates a positive dependence of milk production for carrying out breeding according to the size of exterior region.

Key words: Holstein breed, German selection, Dutch selection, lactation, correlation.

INTRODUCTION

The exterior and body physique of animals plays an important role in milk production, as it reflects the intensity and direction of metabolism, the duration of use of cows. The constitution of animals makes it possible to have an idea about the expressiveness of breed signs, the direction of productivity and health (Gridin, 2015; Lyubimov, 2002; Kogut, 2016). Each breed is characterized by specific exterior features, which are created as a result of appropriate selection and sorting of animals on exterior indicators, taking into account specialization, as well as under the influence of certain environmental conditions (Efimova, 2018; Martynova et al., 2004; 2009).

In many countries with developed dairy cattle breeding (the USA, Canada, European countries), body physique along with indicators of milk productivity is the main breeding attribute when improving dairy breeds (Kondratieva, 2002; Harder, 1989; Corea-Guillen, 2008). Of great importance in the selection work with dairy cattle is the correlation between economic and useful features. When selecting Holstein cattle, it was found that in the selection process, the variability of one of the phenotypic parameters depends on the variability of other economically useful signs. Interest in the

improvement of external forms is due to the existence of correlation variability in the development of individual traits and body proportions with the main selectable signs of milk production of cows, the duration of their lifelong use, reproductive qualities and health (Baranov et al., 2008). About the presence of positive reliable relationship between measurements and milk production of cows has been reported by many scientific studies.

The aim of the research was to study the relationship between measurements and milk production in Holstein cows of German and Dutch breeding.

MATERIALS AND METHODS

Studies on the correlation between milk production and exterior characteristics of Holstein cows of various breeds were carried out in the (J.S.C) Joint-Stock Company herd „Aydyn”, Comrat, Administrative and Territorial Unit Gagauzia, Republic of Moldova. Were used the materials of the obtained results of studies of the exterior of the main measurements of cows after the third calving (Foksha et al., 2018). Between all indicators of the assessment of the exterior and milk production of animals, the relationship was determined by calculating the correlation of the coefficient (r).

Basic data on the milk production of animals were taken from the forms of zootechnical and pedigree accounting. For the assessment, data on the milk productivity of cows with at least three completed lactations was taken: German breeding - the first and second lactation (n=22), the third lactation (n=20); Dutch selection - the first and second lactation (n=42), the third lactation (n=39).

Static processing of research materials was carried out according to the methods of Plohinsky (1978), Merkuryev and Shangin-Berezovsky (1983).

The data obtained in the course of the research were processed biometrically on a personal computer using Microsoft Excel programs; the accuracy of the indicators was determined by Student test.

RESULTS AND DISCUSSIONS

According to the results of the assessment of the indexes of the physique of cows of the German and Dutch breeding after the third calving, it was found that the cows of the German selection exceeded their peers on the index of high-legged by 0.2%; pelvic – by 1.6%, thoracic - by 2.1%, consistency by - 1.8% and overgrowth by 0.5%, (Foksha et al., 2018).

Therefore, the cows of German selection have relatively better development of the breast in depth, respectively, of the chest organs or, they have more developed chest organs, which provide a higher metabolism and what causes higher milk productivity. This is confirmed by the analysis of the level of milk production of animals in the dynamics of the three lactations, (Table 1).

Table 1. Productive qualities of cows of various breeding of Holstein breed for 305 days of lactation, J.S.C. "Aydyn"

Indicators	Breeding	
	Dutch	German
I lactation	n=22	n=42
Yield of milk, kg	8058±176.4***	7207±147.0
Fat, %	3.71±0.05	3.73±0.04
II lactation	n=22	n=42
Yield of milk, kg	8192±157.9	8699±191.5*
Fat, %	3.79±0.03	3.78±0.03
* III lactation	n=20	n=39
Yield of milk, kg	9636±307.8	11165±204.4***
Fat, %	3.84±0.04	3.91±4.5

Note: * III lactation - assessed by measurements; * - P<0.05; *** - P<0.001

Analysis of indicators table 1 indicates that the milk production on the first lactation at cows of German breeding is lower than at their peers from Holland. Thus, for 305 days of the first lactation from German heifers, was received an average of 7,207.6 kg of milk, while from the Dutch - 8058.3 kg, which is by 851 kg less, the difference is significant at P<0.001. From the second lactation at cows of German breeding, a significant increase of milk productivity has been observed, therefore for the next 2 lactations they exceeded their peers in milk yield by 507 kg of milk (II lactation, P<0.05) and 1529 kg of milk (III lactation, P<0.001) accordingly (Figure 1).

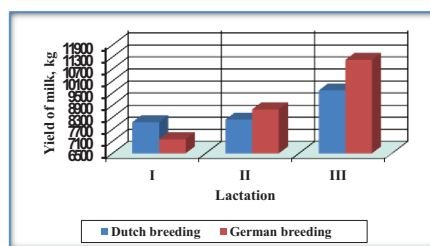


Figure 1. Dynamics of milk productivity of cows of various selections of the herd of J.S.C. „Aydyn”

It should be noted that the change of the conditions of keeping and feeding did not lead to a decrease of the productive abilities of animals of the Dutch and German breeding. Under the new conditions of keeping a cow of Holstein and German breed, realize their genetic potential at a high level.

A comparative analysis showed that at the tested heifers' population, the realization of the genetic potential differs insignificantly in comparison with the average indicators for the herd (Foksha et al., 2018) and constitutes 80.2 and 69.2% Dutch and German selection, respectively (Figure 2).

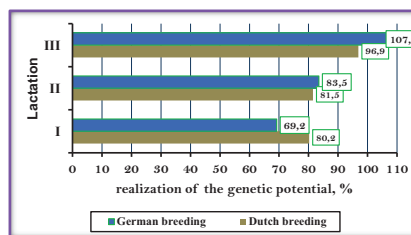


Figure 2. Realization of the genetic potential of milk productivity in the dynamics of lactation of Holstein cows of the Dutch and German breeding

As it can be seen, in the second and third lactations at cows of the German breeding, the implementation of the genetic potential was at the level of 83.5 - 107.2%, which is by 2.4 and 9.6% higher than that of the peers of the Dutch breeding.

For a more complete assessment of the character of the connections of milk production

at cows of the III lactation of various breeds, a study was conducted of the presence of correlation between milk yield, fat content in milk and measurements.

Table 2 presents the results of the correlation interrelation of traits of the exterior of cows with milk productivity.

Table 2. The coefficients of correlation of breeding signs - yield – measurements ($X \pm Sx$) of cows for the III lactation, J.S.C. „Aydyn”

Correlated sign	Breeding	
	German	Dutch
Yield of milk and height at withers	-0.244±0.143	0.077±0.226
Yield of milk and height in sacrum	-0.271±0.140	-0.197±0.211
Yield of milk and depth of chest	-0.271±0.140	0.05±0.230
Yield of milk and breast width behind the shoulder blades	0.232±0.144	-0.167±0.215
Yield of milk and width of a croup	0.336±0.134	0.665±0.136
Yield of milk and width in sciatic tubercles	0.196±0.147	-0.145±0.218
Yield of milk and slanting length of body	0.018±0.163	-0.276±0.200
Yield of milk and girth of chest behind the shoulder blades	0.364±0.131	-0.3±0.197
Yield of milk and girth of the pastern	0.19±0.148	-0.008±0.235

Analysis of the results of the interrelation of the milk yield with the measurements of traits of cows exterior revealed a dependence on slightly negative -0.008 (metacarpus girth) to positive - +0.665 (width of a croup) at cows of Dutch breeding

The average interrelation of milk yield was established at cows of German breeding with a chest girth behind the shoulder blades - +0.364 and a width of a croup - +0.336, which indicates a positive dependence of milk production for carrying out a selection according to the size of traits of the exterior. A weak correlation is established between the milk yield and the width of the breast behind the shoulder blades - 0.232; the width in the sciatic tubercles is 0.196 and the girth of the pastern at cows of German breeding, the relationship is positive.

A weak negative correlation was established between the high-altitude measurements at cows of German breeding (height at withers and sacrum).

It should be noted that at cows of German breeding, on the background of higher productivity (11165 kg versus 9636 kg), the interrelation of milk yield with such measures as breast width behind the shoulder blades, width in the sciatic tubercles, girth of chest behind the shoulder blades and girth of the pastern is much higher than those of Dutch origin.

At cows of German breeding is established a weak negative relationship with 8 out of 9 studied measurements with the content of milk fat (Table 3).

Table 3. The coefficients of the relationship of breeding signs ($X \pm Sx$) of cows of III lactation, J.S.C. „Aydyn”

Correlated sign	Selection	
	German	Dutch
Fat content and height at withers	-0.237±0.143	0.031±0.232
Fat content and height in sacrum	-0.201±0.147	0.080±0.226
Fat content and depth of chest	-0.102±0.156	-0.222±0.208
Fat content and breast width behind the shoulder blades	-0.102±0.156	-0.148±0.217
Fat content and width of a croup	-0.176±0.149	0.230±0.207
Fat content and width in sciatic tubercles	0.046±0.160	0.124±0.221
Fat content and slanting length of body	-0.114±0.155	0.274±0.201
Fat content and girth of chest behind the shoulder blades	-0.281±0.139	-0.289±0.198
Fat content and girth of the pastern	-0.017±0.163	-0.248±0.204

The correlation of body measurements with the content of milk fat for these animals varies from -0.017 (girth of the pastern) to 0.046 (width in sciatic tubercles).

It is noteworthy that the cows of the Dutch breeding have a weak positive relationship with the content of milk fat with a width of a croup (0.230) and slanting length of body (0.274).

For the other measurements, there is a slight positive or weak negative relationship in the range -0.148 (breast width behind the shoulder blades) to -0.289 (girth of chest behind the shoulder blades). Similar results received in their studies (Novikov Leshonok, 2014).

Since the samples were not numerous, most of the correlation coefficients were not statistically significant. Comparison of the results did not reveal regularities among the studied signs.

CONCLUSIONS

For 305 days of lactation from the Dutch heifers, was received milk more by 851 kg than from their peers of German breeding, the difference is significant ($P < 0.001$). Since the second lactation at cows of German breeding is observed an increase in milk productivity. Therefore, for the next 2 lactations, they exceeded their peers in milk yield by 507 kg of milk (II lactation, $P < 0.05$) and 1529 kg of milk (III lactation, $P < 0.001$), respectively.

Indicators of the exterior of cows of the third lactation have an interconnection with milk production. It was established the average relationship of the milk yield of cows of German breeding with girth of chest behind the shoulder blades (+0.364) and width of a croup (+0.336). A weak correlation is established between the milk yield and the breast width behind the shoulder blades (+0.232), width in sciatic tubercles (+0.196) and the girth of the pastern at cows of German breeding, the relationship is positive.

REFERENCES

- Baranov, A., Sirotina, M., Muradova, L. (2008). Phylum of Kostroma cattle by a complex of characters. *Journal Dairy and beef cattle*, 4, 12-13.
- Danilkiv, O.N., Siratsky, I.Iz. (2001). Curvilinearity of the relationship between the level of milk yield of cows and exterior indicators. *Journal Zootechny*, 9, 2-3.
- Corea-Guillen, E.E., Alvarado-Panameno, J.F., Leyton-Barrientos, L.V. (2008). Effect of change in body condition, race and number of births in the reproductive performance of dairy cows. *Mesoamerican agronomy*, 19 (2), 251-259.
- Efimova, L.V., et al. (2017). The relationship between the characteristics of the linear assessment of the exterior and milk productivity of cows. *Bulletin of the Novosibirsk State Agrarian University*, 3(44), 115-124.
- Foksha, V., Konstandoglo, A., Morar, Cr., Peykov, G., Tataru, Gh. (2018). Exterior of Holstein cows of Dutch and German breeding. *Scientific Papers, Series D, Animal Science*, Bucharest, LXI(1), 46-51.
- Gridin, V.F. (2015). The relationship of milk production of heifers of various breeding with body parameters. *Agrarian Bulletin of the Urals*, 1(131), 41-43.
- Gritsenko, S.A., Zaydullina, A.A., Shaykhislamov, A.G., Norov, N.V. (2006). Interconnection of the productivity of black-motley cattle in the southern Urals region with exterior features. *Journal Zootechny*, 12, 10-11.
- Harder, M. (1989). The influence of the exterior on the duration of economic use and lifetime milk production in cows. *Lbl. Land Milchwirtschaft*, 78(23), 31-34.
- Kogut, M.I., Bratyuk, V.M., Dankiv, V.Y. (2016). Relationship between the exterior and milk production of Simmental cows. *Foot-hill and mountain agriculture and stock-raising*, 59, 199-204.
- Kondratieva, T.N. (2002). The influence of genetic and environmental factors on productive and exterior signs of Ayrshire cattle: *Abstract of the doctoral thesis of agricultural sciences*, Veliky Novgorod, 22.
- Lyubimov, A.I., Martynova, E.N., Pushkarev, O.G., (2002). Exterior types of Kholmogor-Holstein cows. *Tr. region. scientific and practical conf. "Agrarian science - the state and problems: Izhevsk."* Izhevsk State Academy of Agriculture, I, 179-180.
- Martynova, E.N., Devyatova, Y.V. (2004). Linear evaluation of the exterior of black-motley animals and its relationship with milk production. *Dairy and beef cattle*, 8, 23.
- Martynova, E.N., Tyulkina, G.G. (2009). Exterior features of the heifers of various breeding in Kipun LLC of the Sharkun district of the Udmurt Republic. *Zootechnical science on the Udmurt land. State and prospects: materials of the Intern. scientific-practical conf. Izhevsk: Federal State Budgetary Educational Institution of Higher Education "Izhevsk State Agricultural Academy"*, 82-84.
- Martynova, E.N., Shirobokova, Y.V. (2015). Exterior features and productivity of the heifers of black-motley breed of various generations. *Materials All-Russia. Scientific-practical conf. "The role of young innovative scientists in solving problems of accelerated import substitution of agricultural products"* Izhevsk: Federal State Budgetary Educational Institution of Higher Education "Izhevsk State Agricultural Academy", 107-109.

- Merkurieva, E.K., Shangin-Berezovsky, G.N. (1983). *Genetics with the basics of biometrics*. Moscow, Kolos, 400.
- Novikov, A.V., Leshonok, O.I., (2014). Relationship between the exterior and the milk productivity of heifers. *Agricultural and food policy of Russia*. Published: Ural Research Institute of Economic and Food Security, Tyumen, 4(28), 49-51.
- Plokhinsky, N.A. (1978). *Mathematical methods in biology*. Moscow, Moscow State University. 265.
- Seltsov, V.I. (2000). Optimal parameters of the exterior of Simmental cows. *Journal Zootechny*, 2, 10-12.
- Sidorova, V.Y. (2006). Exterior signs of dairy cattle of the Russian Federation and their relationship with productivity. *Journal Zootechny*, 5, 4-6.