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Genetic potential analysis of productivity in Holstein dairy cattle

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ABSTRACT

In domestic livestock production, one of the most complex sectors livestock is dairy cattle breeding. Milk yields >10,000 kg/year are common in modern dairy production, owing to improved nutrition, management and genetic gains through use of progeny-tested bulls. However, reproductive performance has decreased worldwide in many cows with a high genetic potential for milk production, particularly in the Holstein breed. The production of milk has been observed in the Al-hiera project in Libya through the importation of highly productive pedigree dairy cattle from abroad. Everywhere, old farms are being reconstructed, new complexes are being constructed that are not inferior to dairy equipment of foreign level. Intensive technology of dairy cattle breeding is a complex of highly effective methods of breeding, feeding, keeping and using animals, ensuring their high productivity, labor productivity, production culture and product quality. Central to the introduction of intensive technologies is breeding work, the goal of which is to search for the most valuable heredity potential. The article shows that there are no significant differences between the experimental groups with age and those differences that were found to be statistically not authentic. The superiority in the milk productivity of cows obtained from the "refreshment" of blood in the third lactation over the local dildos did not affect their reproductive ability. This is evident from the servis period in cows in the third lactation, which is 52 days in the control group and 63 days in the control group cows.

Keywords: *Potential, Holstein Frisian, Dairy cattle, Reproductive, Genetic.*

1. INTRODUCTION

Intensive technology of dairy cattle breeding is a complex of highly effective methods of breeding, feeding, keeping and using animals, ensuring their high productivity, labor productivity, production culture and product quality. Central to the introduction of intensive technologies is breeding work, the goal of which is to search for the most valuable genotypes and to maximize their use in the population.

The process of intensification in dairy cattle breeding has changed the requirements for the breeds of dairy and beef cattle. Huge investments in the construction of dairy complexes are justified only if the overall economic effect is achieved due to the high milk productivity of cows [1-5].

In these conditions, the improvement of breeding qualities of livestock, aimed at increasing the productivity and availability of animals for exploitation in industrial technology, is of great importance. This problem is solved, first of all, both by intra-breed selection, and on the basis of interbreeding.

In recent years, breeding cows of local breeds with bulls and dairy-meat breeds exported from foreign countries has been used to increase the productivity of herds [6-10].

Of interest in this respect is the Holstein Frisian Dairy cattle, which has a high genetic potential for dairy productivity, an excellent shape of the udder and the properties of milk yield, meeting modern requirements of machine milking.

In the south of Russia, cows of the Schwick breed have been bred for ages. The average productivity of cows here varies from 3200 to 4300 kg, with a fat content of 3.2 to 5.0%, which, especially for butterfat milk, is not inferior to other breeds bred in the region [11-15].

There is a high efficiency of the use of American bulls-producers for the improvement of the Schwick cows of the local population. It was found that the milk yield for the animals of the first generation, the percentage of fat and total fat for the first lactation is higher than for purebreds at 228 kg, 0.07% and 10.2 kg, respectively, the difference in the second lactation was 328 kg, 0.07% and 14 kg respectively. With the second generation, the difference is somewhat reduced, in comparison with the purebred contemporaries, and makes 163 kg, 0.12% and 8.6 kg respectively, according to the first lactation, and 88 kg, 0.11% and 5.8 kg according to the second lactation respectively, in addition to the percentage of fat in milk.

2. MATERIAL AND METHODS

The study was conducted at Tripoli- Libran Dairy Farm Tripoli city is located in the north-western part of Libya at 32° 54' North latitude and 20° 4' East longitude, Tripoli city has a hot subtropical semi-arid climate with long, hot and dry summers with relatively wet and mild winters with a Mediterranean (dry-summer) rainfall pattern. Its summers are hot with temperatures that often exceed 38 °C (100 °F); average July temperatures are between 22 and 33 °C (72 and 91 °F). In December, temperatures have reached as low as 0 °C (32 °F), but the average remains at between 9 and 18 °C (48 and 64 °F). The research was carried out in Dairy cattle at Al-hiera project, Al-hiera region

In our studies, milk productivity of first-lactation cows is given in table 1.

3. RESULTS AND ITS DISCUSSION

Any animal breeding program is based on three main components: assessment of breeding qualities of animals, formation of breeding groups (fathers of bulls, fathers of cows, mothers of bulls and mothers of cows) and their intensive use in the system of reproduction of breeding genetic material. At the same time, regional breeding programs are the basis for the formation of an optimal breeding program for animals at the pedigree level. Priority value in their optimization belongs to the accuracy and objectivity of evaluation of the breeding qualities of animals.

From the data of the table, we see that, according to the productive indices, the first-caliber of the two compared groups did not have large differences. However, according to milk yields, the daughters of Holstein Frisian Dairy cattle were 54 kg or 2%, and in terms of their fat content in milk, they were 0.02% higher than the Schwick cows of the local population. Differences between groups were statistically unreliable, td = 0.3 at P <0.9.

In the breeding of dairy cattle with the use of cows at industrial complexes, the equalization of groups of animals by one or another characteristic, and especially by milk, is of great importance, since all this is connected with the technological processes of obtaining milk. The more equal the groups of cows in terms of milk yield, the more effective the operation of milking plans.

Table 1. Productive characteristics of first-aid in the first lactation

Symptom	Group				Reliability of the difference	
	Control		Experienced			
	$X \pm m_x$	Cv	$X \pm m_x$	Cv	td	P
yield, kg	2357 ± 113	18.6	2411 ± 107	17.2	0.3	<0.9
Percent fat,%	3.82 ± 0.02	1.5	3.84 ± 0.02	2.2	0.7	<0.9
Total fat, kg	90.0 ± 2.2	9.3	92.6 ± 1.9	7.9	0.9	<0.9
Live weight, kg	389 ± 4.1	4.1	394 ± 3.9	3.8	0.9	<0.9
Service period, days.	71 ± 2.7	15	53 ± 2.5	18	4.9	> 0.999
Coefficient of milk, kg	606		612			

The alignment of groups is determined by one or another characteristic, by calculating the coefficient of variation of the trait. The coefficient of variation in the milk yield of the analyzed cows has a sufficient value for breeding on this basis, but not so great that

it has a great economic impact when operating milking plants. At the same time, the cows-first-calves of the experimental group were more homogeneous, yielding 1.4% to the peers of the control group. It should be noted that this figure was 17.2% for daughters of Holstein Frisian Dairy cattle bulls, which is 1.4% less than the similar figure for local breed. All this indicates the potential for effective selection to further increase productivity.

Observing the difference in milk yield between the cows of the groups under analysis, one should take into account their fat-milkiness when assessing cows, as the milk component determining the quality of milk is the amount of milk fat. Its content depends on many factors: on the age of animals, feeding, content, breed and breed. The fat content of cows is largely determined by the economic efficiency of breeds of dairy cattle.

The most valuable and indispensable product in human life is the livestock product, produced from milk - butter. For the production of this product, the quantity of milk and butterfat milk, as the matched characteristics for obtaining the conjugate trait (the general milk fat) is of great importance.

Many studies indicate that the amount of total milk fat depends on 80% of the milk yield and 20% of the percentage of fat in milk.

Our studies are consistent with the opinion of many researchers that the yield of total milk fat is more dependent on the amount of milk of cows. Thus, the cows of the experimental group exceeded the cows-peers of the control group by the amount in milk of milk fat by 2.6 kg. Having a slightly larger fat content in milk (0.02%), the difference was statistically unreliable td = 0.9 or P <0.9.

Selection by this feature will be carried out quite effectively, as indicated by the coefficient of variation. This genetic parameter in the cows of the control group was 9.3%, which is 1.4% higher than that of the daughters of the Holstein Frisian Dairy cattle.

An important indicator of the productivity of animals is the milk ratio, which is defined as the ratio of milk yield for lactation to live weight expressed as a percentage [16-20].

The results of the study of this feature showed that the offspring of Holstein Frisian Dairy cattle exceeded the purebred by 1%. If we try to determine the direction of productivity, then according to the production classification, the first-calf cows are referred to the milky-meat type of animals. The difference on the basis of the service period for 18 days between the groups was statistically significant td = 4.9 or P> 0.999, which is of considerable significance in breeding cows for reproductive ability.

The variability of the trait was higher for first-generation cows, which amounted to 18%, and for purebreds - 15% or the first 3% higher than the second.

At the present stage, for the provision of people with the most valuable product of animal husbandry - meat, the value of cows, its live weight, as the production of beef from dairy and combined breeds is within 85% of the total production of beef [21-25].

In addition, in dairy cattle, the live weight of cows to a certain extent affects the amount of milk, thereby increasing the economic efficiency of livestock in the economy.

The study of the live weight of cows according to the first lactation showed that the advantage was for the animals of the experimental group who weighed 394 kg with an average, which exceeded by 1.2 the peers from the control group. This superiority proved to be unreliable, td = 0.9 or P <0.9.

The problem of selection in industrial complexes for increasing milk productivity must be closely related to the intensive exploitation of cows and the nature of their distribution, which can be judged from the age-related changes in milk productivity.

The changes in the milk yield with age are indicated by the studies of many authors. There is an opinion that highly productive cows on the first lactation were the best and in subsequent lactations.

In our studies, the study of the same characteristics for the second lactation cows in the experimental first-calf cows is given in Table 9. It can be seen from the data in Table 9 that according to all the main indicators, the daughters of import selection have the advantage given in the table. So, according to the milk yield of the first group of the experimental group for the second lactation, 419.0 kg exceeded the control animals. Here it will be appropriate to say that in comparison of the animals of the second lactation with the first, the advantage was: between daughters 1 and 2 lactations by milk yield of 788 kg, milk fat - 29.6 kg, live weight by 40 kg, milk ratio by 20.4%. This difference was statistically significant td = 2.7 or P> 0.95.

The cows of the control group of the second lactation increased their milk production by 423 kg or by 17.9%, in comparison with the first lactation. The data cited indicate a more intensive portion of the experimental group for the second lactation compared to the animals of the first lactation. The service period in the experimental groups of cows of the second lactation was significantly shorter than that of the first-first lactation.

In connection with the expansion of the cows of the experimental group, the coefficient of variation of milk yield in the age of the second lactation decreased, in comparison with the first lactation by 1.9%, in cows-mates, respectively, by 5.4%. The variation coefficient for this trait by the second lactation was 15.3% and 13.2%, respectively, in the groups analyzed.

Table 2. Productive characteristics of cows of the second calving

Symptom	Group				Reliability of the difference	
	Control		Experienced			
	$X \pm m_x$	Cv	$X \pm m_x$	Cv	td	R
yield, kg	2780 ± 95	13.2	3199 ± 126	15.3	2.7	> 0.95
Percent fat,%	3.8 ± 0.03	2.6	3.82 ± 0.04	3.7	0.4	<0.9
Total fat, kg	105.6 ± 3.3	12	122.2 ± 4.8	15.3	2.8	> 0.95
Live weight, kg	428 ± 4,2	3.8	434 ± 4.4	3.9	1	<0.9
Service period, days.	62 ± 4.9	30.5	34 ± 0.5	5.7	5.7	> 0.999
Coefficient of milk, kg	650		737			

This coefficient of variation coefficient will contribute to the selection of milk production in cows. The results of the research show that in comparison with the cows of the first lactation the animals of the second lactation were more consolidated by the studied feature.

The difference between the groups in terms of the percentage of fat in milk turned out to be unreliable td = 0.4 or P <0.9. The difference in the percentage of fat and milk yield in the groups contributed to the difference in the total amount of milk fat between the groups, it was higher in cows in the second lactation than in the first lactation and amounted to 16.6 kg, instead of 2.6 kg for the first lactation. The difference in the total amount of milk fat between the cows in the second lactation proved to be significant td = 2.8 or P> 0.95. A significant difference in the milk ratio of 87 kg between cows in the second lactation contributed to a significant superiority in milking the experimental group cows over control peers.

Differences in live weight between the experimental groups were statistically unreliable, td = l or P <0.9.

Attaching great importance to the dairy and meat productivity of cows, their reproductive qualities should not be missed in breeding work. As can be seen from our research data, the service period, which determines the reproductive capacity of cows, showing the period of restoration of the involution of the uterus and, thus, the preparedness of the cow for further reproduction of the offspring, was longer in the Holstein Frisian Dairy cattle of the local population than in the daughters of the Holstein Frisian Dairy cattle breeding and was 62 days. In this case, this difference proved to be reliable td = 5.7 or P> 0.999.

The process of further exploitation of cows in the conditions of the industrial complex makes demands on the intensive expansion of the first-calves and cows of the second calving, which is closely related to the overstrain of the organism, since high milk yields are associated with large physiological loads.

Highly productive cows, having a powerful milk-forming system, are able to direct the ration to mobilize intensive milk synthesis. This process occurs with a different intensity. Cows are considered full-fat when they start producing on the third lactation (Table 3).

As can be seen from the data in Table 3, the experimental animals were not characterized by the same milk productivity. The cows of the first generation in the third lactation differed from the average lactation by 3769kg of milk, which was 239kg or 6.7% higher than purebreds, but the first in 0.01% was second in fat content in milk. As a result of a higher milk yield, the amount of milk fat was higher in the cows of the experimental group and they were 8.7 kg or 6.4% higher than the girls of the Holstein Frisian Dairy cattle breed of the local population. A similar pattern is observed for other indicators of productivity, where the animals of the experimental group compared to the control group had a significant advantage.

Analyzing the main economic-useful features of experimental cows for the first three lactations, it should be noted that the cows of the third lactation have a great superiority over animals with the second and the first lactations. Thus, the daughters of Holstein Frisian Dairy cattle of the third lactation increased the milk yield by 570 kg of milk in comparison with the animals of the second lactation and by 1358 kg of milk in comparison with the age of the first lactation. A similar situation is observed in the degree of change in the milk yield of the animals in the control group only with the difference that the differences were somewhat lower.

Cows of the local population of the third lactation, in comparison with the second and first lactations, increased their yield by 750 and by 1173 kg, respectively.

Table 3. Productivity of cows of the third calving

Symptom	Group				Reliability of the difference	
	Control		Experienced			
	$X \pm m_x$	Cv	$X \pm m_x$	Cv	td	R
yield, kg	3530 ± 173	19	3769 ± 234	24	0.8	<0.9
Percent fat,%	3.8 ± 0.02	2.3	3.79 ± 0.02	2.4	0.4	<0.9
Total fat, kg	134.1 ± 5.9	17th	142.8 ± 8.1	22	0.9	<0.9
Live weight, kg	501 ± 8.8	6.8	510 ± 9.0	6.9	0.08	<0.9
Service period, days.	63 ± 4.9	30.2	52 ± 3.9	29.3	1.8	= 0.9
Coefficient of milk, kg	704		739			

The increase in the milk productivity of cows resulted in a slight increase in the difference in the coefficient of variation between the groups for milking. However, the coefficients of variation of 19% and 24% contribute to breeding in the planned direction to increase the yield of cows.

Cows in the third lactation observed a decrease in the percentage of fat in milk. In this case, the cows of the control group reduced the fat content in milk, in comparison with the first lactation by 0.02%, and compared to the second had the same indicator of 3.8%.

The decrease in the percentage of fat in milk according to the third lactation in the cows of the experimental group is characterized by the following indices: in comparison with the first lactation - by 0.05%, with the second lactation - by 0.03%.

As can be seen, the change in the fat content in milk with the age of lactation is much higher in experimental blood cows than in control cows. This contributed to the superiority of American daughters 'daughters' third lactation over cows - peers by 0.01%, but the difference is statistically unreliable, td = 0.4 or P <0.9.

The superiority in the percentage of fat in the milk of experienced cows in the third lactation did not contribute to superiority on the basis of total milk fat. This can be explained by the superiority of milk on the third lactation, where they had 8.7 kg of milk fat more than the cows-peers. This superiority was statistically unreliable, td = 0.9 or P <0.9.

High milk productivity of first generation cows in the third lactation allowed to obtain a high milk ratio of a high milking factor with practically the same number of milking days.

The superiority in this indicator of the cows of the experimental group over their contemporaries was 49 kg.

4. CONCLUSION

The data obtained on the basis of the analysis of pedigree cards allow one to assume the high genetic potential of cows in both quantitative and qualitative indicators of dairy productivity, while observing the appropriate feeding and maintenance conditions. The study of the productivity indicators of female ancestors of the breeding stock showed that it is characterized by a high genetic

potential. The high genetic potential of dairy productivity is characterized by the ancestors of bulls-fathers on the maternal side. Analysis of the data presented shows that there are no significant differences between the experimental groups with age and those differences found to be not statistically reliable. The superiority in the milk productivity of cows obtained from the "refreshment" of blood in the third lactation over the local dildos did not affect their reproductive ability. This can be seen from the duration of the service period in cows in the third lactation, which is 52 days for the experimental group cows and 63 days for the cows in the control group. The difference in 11 days was reliable, with td = 1.8 or P = 0.9.

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