

ПРОДУКТИВНОСТЬ ПОТОМСТВА БЫКОВ-ПРОИЗВОДИТЕЛЕЙ С РАЗНОЙ ИНДЕКСНОЙ ОЦЕНКОЙ

(✉) Ковалева Г.П., Лапина М.Н., Сулыга Н.В., Витол В.А.

*Всероссийский научно-исследовательский институт овцеводства и козоводства –
филиал Северо-Кавказского федерального научного аграрного центра
Ставрополь, Россия*

(✉) e-mail: skotovodstvo-sniizhk@yandex.ru

Проблема изучения степени влияния индекса «Период продуктивной жизни/продуктивное долголетие» быков-производителей на продолжительность продуктивного использования их потомства недостаточно освещена в научной литературе, что и обосновывает актуальность проведенных исследований. Осуществлена сравнительная оценка хозяйственно-полезных признаков дочерей быков-производителей с величиной индекса от 103 до 117. Динамика выбытия опытных животных определена в период от рождения до завершения второй лактации, уровень молочной продуктивности – по данным за первую и вторую лактации. Установлено, что выбытие среди дочерей быков-производителей с индексом, равным 103 и 105, было наибольшим во все физиологические периоды и составило на конец опыта 80,0 и 78,1% соответственно. В группах дочерей быков-производителей с величиной индекса 109 и 117 доля выбывших животных достигала 62,9 и 65,6%. Наименьшая продуктивность за первую и вторую лактации зафиксирована у дочерей быка-производителя с величиной индекса 103 – 6760,2 и 7100,7 кг молока. Дочери быка-производителя с индексом, равным 117, отличались наибольшей молочной продуктивностью – 7475,9 и 8158,3 кг молока за две лактации. Анализ полученных данных показывает, что закрепление быков-производителей за маточным стадом с учетом индекса «Период продуктивной жизни/продуктивное долголетие» позволит получать более крепкое потомство с хорошими продуктивными качествами.

Ключевые слова: быки-производители, индекс оценки, продуктивное долголетие, выбытие, сохранность поголовья

PRODUCTIVITY OF THE SERVICING BULLS PROGENY WITH DIFFERENT INDEX SCORES

(✉) Kovaleva G.P., Lapina M.N., Sulyga N.V., Vitol V.A.

*All-Russian Research Institute of Sheep and Goat Breeding - Branch of the North Caucasian
Federal Scientific Agrarian Center
Stavropol, Russia*

(✉) e-mail: skotovodstvo-sniizhk@yandex.ru

The problem of studying the degree of influence of the index "Period of productive life/productive longevity" of the servicing bulls on the duration of productive use of their progeny is not sufficiently covered in the scientific literature, which substantiates the relevance of the research. A comparative assessment of economically useful features of the daughters of servicing bulls with the index value from 103 to 117 has been carried out. Dynamics of the experimental animals' mortality is determined in the period from birth to the end of the second lactation, the level of milk productivity - according to the data for the first and second lactations. It was found that mortality among the daughters of the servicing bulls with an index equal to 103 and 105 was the highest in all physiological periods and amounted to 80.0 and 78.1% at the end of the experiment, respectively. In the groups of the daughters of the servicing bulls with index values of 109 and 117, the proportion of animals that died out reached 62.9 and 65.6%. The lowest productivity for the first and second lactations was recorded in the daughters of the servicing bull with the index value of 103 - 6760.2 and 7100.7 kg of milk. The daughters of the servicing bull with the index equal to 117 were distinguished by the highest milk productivity - 7475.9 and 8158.3 kg of milk in two lactations. Analysis of the obtained data shows that fixation of servicing bulls to the breeding herd taking into account the "Period of productive life/productive longevity" index will make it possible to obtain more robust progeny with good productive qualities.

Keywords: servicing bulls, assessment index, productive longevity, mortality, livestock viability

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INTRODUCTION

The profitability of dairy cattle farming directly depends on the productivity of the animals. In the Russian Federation, the task of increasing milk productivity is solved through the extensive use of the Holstein breed gene pool. Although the Holstein breed ranks second in terms of population size in our country, representatives of other breeds of dairy cattle carry a certain proportion of Holstein blood¹ in their genotype [1–3]. However, high productivity is an antagonist to animal health indicators. Holsteinized cattle have a low potential for immune defense, which results in the productive lifespan of Holsteinized dairy cows being less than three lactations^{2,3} [4, 5]. Recently, great attention has been paid to animal health, their reproductive ability, and productive longevity [6–8]. The productive longevity of dairy cows is determined not only by their genotype but also

by the influence of the environment. Among the genetic factors influencing the productive longevity of dairy cattle, the genotype of the sire plays a decisive role^{4–6}. Рентабельность молочного скотоводства напрямую зависит от продуктивности животных.

In the last 20 years, selection and breeding of animals based on selection indexes have been successfully used in dairy breeding. Genetic indexes facilitate the work of breeders in cattle breeding and increase production profitability⁷ [9]. Sire evaluation is based not only on the productive traits of their daughters but also on health indicators, particularly the "Productive Life (PL)/Longevity" index. Offspring of sire bulls with this index evaluation exhibit high indicators of nonspecific immunity and reproductive ability [10]. It is assumed a priori that any sire bull with an index evaluation above 100 can improve this indicator in its

¹Karamaev A.S., Zaitsev V.V. Indicators of natural resistance of cows of different breeds // Izvestiya of the Lower Volga Agro-University Complex. 2011. N 1 (21). pp. 150–153.

²Pilipenko M.A. Influence of stud bulls on the duration of economic use of daughters // Agrarian Bulletin of the Urals. 2011. N 12-2 (92). pp. 46–48.

³Serdyuk G.N. Problems of productive longevity at Holsteinization of domestic breeds of cattle // Dairy and Beef Cattle Farming. 2015. N 6. pp. 7–10.

⁴Koronets I.N., Klimets N.V., Shemetovets J.I., Pesotsky N.I. Evaluation of the breeding value and selection of highly productive cows on a set of traits // Zootechnical Science of Belarus. 2006. Vol. 41. pp. 61–68.

⁵Gavrilenko V.P. Evaluation and selection of dairy cattle on productive-reproductive index // Vestnik of Ulyanovsk State Agricultural Academy. 2009. N 3 (10). pp. 10–14.

⁶Telezhenko E.V. World tendencies in selection of Holstein cattle // Genetics and breeding of animals. 2014. N 2. pp. 38–39.

⁷Bolgov A.E. Biological, selection and technological factors of innovation use in pedigree dairy cattle breeding // Proceedings of Petrozavodsk State University. 2015. N 8 (153). pp. 30–34.

offspring. However, there is no data in the scientific literature on how the magnitude of the aforementioned sire bull index is related to the productive longevity of its progeny.

The purpose of the study is to determine the influence of the magnitude of the "Productive Life/Longevity" index of sire bulls on the survival and productive qualities of their daughters.

MATERIAL AND METHODS

The work was conducted from 2017 to 2021 at the agricultural production cooperative "Kazminsky" in the Kochubeyevsky municipal district of the Stavropol Territory, Russia. This farm is a breeding facility specializing in Holstein dairy cattle. Through years of targeted selection for increasing the quantitative and qualitative indicators of milk productivity, milk yields have been raised to 8056 kg per cow, but the duration of productive use for most animals still remained within one to two lactations.

In 2017, the Black-and-White dairy cows were used for artificial insemination by the Holstein bulls Alta-Red 66726504, Mirok-M 5226675598, Allhard 65431789, and Memory-M 54215651. The magnitude of the "Productive Life/Longevity" index for these bulls was 103, 105, 109, and 117, respectively. In 2018, a total of 815 daughters were obtained from these bulls and divided into four experimental groups: Group 1 - offspring of Alta-Red, Group 2 - offspring of Mirok-M, Group 3 - offspring of Allhard, and Group 4 - offspring of Memory-

M. All experimental animals were kept on the same farm under identical feeding and management conditions that met their physiological and technological needs.

Observations on the animals were conducted from birth until the completion of the second lactation. Exclusion was recorded during the following life periods: from birth to 9 and 18 months of age, and from birth to the completion of the first and second lactations. The information and analytical system "SELEX. Dairy Cattle" was used as the data source.

RESULTS AND DISCUSSION

The dynamics of exclusion and the level of daughter retention of bulls with different "Productive Life/Longevity" index values over the entire observation period are presented in Table 1.

Among the heifers up to 9 months of age, the highest percentage of exclusion was recorded in the 1st and 2nd experimental groups, at 17.0% and 17.9% respectively, which is 7.5% and 8.6% higher than the 3rd group and 10.1% and 11.0% higher than the 4th group.

During the period from birth to 18 months of age, the superiority also remained with the representatives of the 3rd and 4th experimental groups. Compared to the 1st and 2nd groups, the difference was 13.0% and 12.8% in favor of the 3rd group, and 12.5% and 13.2% in favor of the 4th group.

The greatest difference in the exclusion rate was observed during the period from birth to the completion of the first and second lactations,

Табл. 1. Выбытие и сохранность опытных животных
Table 1. Mortality and preservation of experimental animals

Indicator	Experimental group			
	1st (n = 100)	2nd (n = 501)	3rd (n = 54)	4th (n = 160)
The number of excluded animals, heads:				
from birth to 9 months	17 (17,0%)	90 (18,0%)	5 (9,3%)	11 (6,9%)
from birth to 18 months	30 (30,0%)	154 (30,7%)	7 (13,0%)	28 (17,5%)
from birth to the end of the first lactation	56 (56,0%)	232 (46,3%)	19 (35,2%)	54 (33,8%)
from birth to the end of the second lactation	80 (80,0%)	390 (77,8%)	34 (63,0%)	105 (65,6%)
Herd retention after completion of the second lactation, %	20,0	22,2	37,0	34,4

which is when the cost of rearing non-milking animals is recovered. During this period, the attrition rate of daughters from the bull Alta-Red 66726504, who had the lowest "Productive Life/Longevity" index, reached 56.0% and 80.0%. In the group of daughters from the bull Mirok-M 5226675598 (index value 105), the percentage of animals excluded before completing the first lactation was 46.3%, which is 9.7% lower than in the 1st experimental group. However, after completing the second lactation, the differences between these groups decreased to 1.9%.

Among the daughters of the bulls Allhard 65431789 and Memory-M 54215651 (index values 109 and 117, respectively), the exclusion rate from birth to the completion of the first lactation was 20.8% and 22.3% lower than in the 1st experimental group, and 11.1% and 12.6% lower than in the 2nd group. During the period from birth to the completion of the second lactation, the difference between the 1st and 3rd groups, and the 1st and 4th groups, was 17.1% and 14.4%, while between the 2nd and 3rd groups, and the 2nd and 4th groups, it was 15.2% and 12.5%, respectively.

After completing the second lactation, the lowest exclusion rate was observed in the 1st experimental group (20.0%), while the highest was in the 3rd group (37.1%). In the 4th group, where the bull had the highest index, the daughter retention was 2.7% lower than in the 3rd

group. Possibly, the level of milk productivity had a negative influence on this indicator, as the animals in the 4th experimental group had higher milk yields in both the first and second lactations compared to the 3rd experimental group (see Table 2).

During the first lactation, the highest milk yield was obtained from the animals in the 4th experimental group - 7475.9 kg (a 24.1 kg difference compared to the 2nd group).

The lowest amount of milk was obtained from the 1st experimental group - 6760.2 kg, which was 715.7 kg less than from the animals in the 4th group. In terms of milk yield, the animals in the 2nd, 3rd, and 4th groups significantly outperformed those in the 1st experimental group ($p > 0.999$). However, the animals in the 1st group had better milk quality characteristics: fat content was 4.06% ($p > 0.99$), and protein content was 3.18%.

The same trend was observed in the results of the second lactation. The animals in the 4th experimental group also had the highest milk yield - 8158.3 kg. The difference in this indicator compared to the 2nd and 3rd groups was 14.3 kg and 524.2 kg respectively. The largest difference in milk yield was observed between the 1st and 4th groups - 1057.6 kg ($p > 0.999$).

Thus, the daughters of the bull Alta-Red, who had an index value of 103, not only had the lowest retention rate but also showed lower milk yield performance in both completed lac-

Табл. 2. Молочная продуктивность опытных животных

Table 2. Milk productivity of experimental animals

Indicator	Experimental group			
	1st (n = 100)	2nd (n = 501)	3rd (n = 54)	4th (n = 160)
<i>First lactation</i>				
Number of heads	44	269	35	106
Milk yield, kg	6760,2 ± 52,0	7451,8 ± 44,6**	7294,1 ± 49,6**	7475,9 ± 50,9**
Milk fat content, %	4,06 ± 0,09*	3,91 ± 0,10	3,92 ± 0,08	3,87 ± 0,07
Milk protein content, %	3,18 ± 0,09	3,16 ± 0,08	3,16 ± 0,08	3,12 ± 0,07
<i>Second lactation</i>				
Number of heads	15	78	13	41
Milk yield, kg	7100,7 ± 206,1	8144,0 ± 151,3*	7634,1 ± 318,0	8158,3 ± 115,6**
Milk fat content, %	3,99 ± 0,01	3,9 ± 0,01	3,93 ± 0,02	3,95 ± 0,01
Milk protein content, %	3,17 ± 0,02	3,15 ± 0,01	3,19 ± 0,01	3,18 ± 0,02

* $p > 0,99$.

** $p > 0,999$.

tations. The daughters of the bull Memory-M with an index value of 117 were the milk yield leaders and only slightly differed in retention rate from the animals in the 3rd experimental group.

The difference in the milk yield between the 2nd and 4th groups, both in the first and second lactations, was minimal, indicating that the use of bulls with a "Productive Life/Longevity" index value of at least 105 in breeding has a positive influence on the productive qualities of the offspring.

CONCLUSION

Based on the conducted research, reliable results have been obtained, proving that the selection of sire bulls taking into account the "Productive Life/Longevity" index value contributes to the improvement of offspring retention and productive qualities. The highest heifer survival rate was observed in the 2nd and 3rd experimental groups in all evaluated age periods. By the end of the second lactation, the retention rate of animals in these groups was on average 15% higher than that of their counterparts. Therefore, the offspring of the bulls with high values of this index exhibits high indicators of nonspecific immunity. Significantly lower productivity indicators were recorded only in the animals of the 1st group. Since the first two lactations are when the cost of rearing non-milking animals is recovered the most, the application of the studied breeding approach will increase the profitability of milk production.

Thus, we recommend using the method of selecting sire bulls based on the "Productive Life/Longevity" index value (≥ 109) in the breeding process, which will result in obtaining more robust offspring and increasing the profitability of milk production.

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ИНФОРМАЦИЯ ОБ АВТОРАХ

✉ **Ковалева Г.П.**, кандидат сельскохозяйственных наук, доцент, ведущий научный сотрудник; **адрес для переписки:** Россия, 355017, г. Ставрополь, пер. Зоотехнический, 15; e-mail: skotovodstvo-sniizhk@yandex.ru

Лапина М.Н., кандидат биологических наук, ведущий научный сотрудник

Сулыга Н.В., кандидат биологических наук, ведущий научный сотрудник

Витол В.А., кандидат сельскохозяйственных наук, старший научный сотрудник

AUTHOR INFORMATION

✉ **Galina P. Kovaleva**, Candidate of Science in Agriculture, Associate Professor, Lead Researcher; **address:** 15, Zootechnical Alley, Stavropol, 355017, Russia; e-mail: skotovodstvo-sniizhk@yandex.ru

Marina N. Lapina, Candidate of Science in Biology, Lead Researcher

Natalia V. Sulyga, Candidate of Science in Biology, Lead Researcher

Vladimir A. Vitol, Candidate of Science in Agriculture, Senior Researcher

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