

Conference Paper

Role, Importance and Peculiarities of Record Cows in the Formation of High-Production Herds

Vladimir M. Gukezhev, Musa S. Gabaev, and Zhamal K. Zhashuev

Laboratory of Livestock and Feed Production, Institute of Agriculture – Branch of the Federal State Budget Scientific Institution Federal State Budgetary Scientific Institution Federal Scientific Center “Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences” (Institute of Agricultural Sciences, KBSC RAS), Nalchik, Russian Federation

ORCID:

Vladimir M. Gukezhev: <http://orcid.org/0000-0001-7170-8805>

Abstract

Throughout the history of the development of dairy cattle breeding, particular importance has always been attached to the identification and rational use of record cows. The significance of this category of breeding is determined not only by individual indicators, but also by the effect they have on the improvement of the breed and individual herds, primarily through their sons and, to a certain extent, as the ancestors of breeding families. It should be noted that the appearance of a record cow is hardly ever spontaneous or random; as a rule, valuable ancestors are found in their pedigrees, the potential of which can be manifested in descendants when creating appropriate feeding and milking conditions. In this regard, the human factor is very important. This analysis shows that in recent years, the age of the highest productivity has grown significantly in almost all breeds. It seems that this phenomenon is the result of the widespread use of Holstein cattle. If one looks at the origin of Holstein stud bulls, the sperm of which are offered for reproduction, then almost all of them are obtained from first-calf heifers, and only a few from adult cows. It is hard to escape a conclusion that we replicate animals in advance, and then wonder why cows do not have time to recoup themselves and do not reach the classical age of milk productivity – 3-5th lactation. Long-term studies show that the highest yield in the purebred Holstein herds is marked for the 2nd lactation, and then, if the animals survive, the yield decreases. The widespread opinion among Russian livestock breeders, including scientists, is that feeding is to blame for everything. Of course, the level and type of feeding is the foundation of animal health, but many farms provide 7-10 thousand kg per cow per year, and the duration of productive use is reduced, so there must be other factors.

Keywords: dairy cattle breeding, selection, stud bulls, record cows.

1. Introduction

Historically, the main products obtained from cows are milk, and it is this principle that is given the highest priority in the development of breeding value, accounting, production planning, choice of selection methods, animal selection and use [1].

Corresponding Author:
Vladimir M. Gukezhev
kbniiish2007@yandex.ru

Published: 5 April 2021

Publishing services provided by
Knowledge E

© Vladimir M. Gukezhev
et al. This article is distributed
under the terms of the [Creative
Commons Attribution License](#),
which permits unrestricted use
and redistribution provided that
the original author and source
are credited.

Selection and Peer-review under
the responsibility of the DonAgro
Conference Committee.

 OPEN ACCESS

High-production cows with high reproduction rates has always been a strategic direction in breeding practice. Livestock breeders rely, first of all, on those individuals that are sharply distinguished by economically useful features or come from ancestors with record productivity under almost the same conditions of feeding and management. The most important economic advantage of a high-production herd is that in terms of the feed-efficiency per unit of production, they significantly exceed the ordinary cows [2, 3].

In leading countries, the intensification of dairy cattle breeding is ensured by increasing the number of high-production breeds, especially Holstein. The breeders create conditions for the maximum possible implementation of genotype, dairy productivity and economic indicators. Productivity records and reproduction rates of cows can be considered as one of the criteria for the genetic potential of animals, as a characteristic of marginal possibilities for the selection of different breeds. In the history of domestic animal husbandry there are many outstanding high-production animals that have played a significant role in improving the breeding and productive qualities of entire herds [4].

Cows whose lifelong milk yield exceeds 30,000 kg are economically advantageous [5].

In the CIS countries, the distribution of cows to record productivity has always been particularly important. In terms of dairy productivity in this group the best results belong to Rossiyanka 73 and Volga 3790 of the black-and-white breed, among the first-calf heifers – the representatives of the Ukrainian type of black-and-white dairy breed Verbichka 2646 (3/4 in Holstein breed) – over 305 days of I lactation it gave 13320 kg of milk with fat content of 3.96% with milk fat yield of 527.5 kg [6].

In the breeding plant named after the 50th anniversary of the USSR, 14,770 kg of milk with a fat content of 3.90% was received for the II lactation from a cow of Holstein breed Lebyodushka 1907. High productivity was obtained from Holstein cows Povodki 841 (3-14154-4.01) and Taktiki 1596 (2-14113-3.98) at Zarya CJSC breeding plant [7].

Miglior F., Muir B.L., Van Doormaal B.J. (2005) note that among the dairy breeds of the European and American continents, the Holstein breed of the USA and Canada is characterized by the highest genetic potential [8].

From the 1920s of the last century to the present, all world records for dairy productivity belong to cows of the Holstein breed [9].

Poncede Leon R., Guzman G. (1989), Mathweis (1990), Seltsov V.I., Sermyagin A.A. (2014) also note that all world records of dairy productivity are accounted for the Holstein breed [10].

According to Berezina T.I. (2014), the world record for weight per cow for the whole per a herd was set in the USA, California, where on average from 300 cows with three times daily milking 12465 kg of milk with fat content of 3.45% was received [11].

R.V. Diggins (1984) states that all world records for milk fat consumption and output belong to Holstein cows [12]. Thus, in 1975, 365 kg of milk was received from the Beecher Arlinda Ellen cow over 26005 days of the 5th lactation. The highest lifetime yield of milk fat – 7153 kg – was noted in the Briswood Patsi Bar Pontiac 6174402. In 1981, 2,7674 kg of milk with a fat content of 3.8% were received from the Holstein cow Ubre Blanca (Cuba) over 365 days of the 3rd lactation.

Besides, according to Alekseev A.L. and Yudin M.F. (2000), the champion of the world of all breeds of cattle is the Vinkuna 100-125300 of Finnish breed, which gave 6264 kg of milk fat (125287 kg of milk with a fat content of 5%) [13].

According to N.S. Gavrilenko et al. (1998), Reim Mark Jinks cows are considered to be the record holders, from which in 1995, 27473 kg of milk was received over 365 days, with a fat content of 3.2% and protein content of 3.1% (milk fat yield – 878 kg, protein – 851 kg, highest daily yield – 92 kg) and Bell-Jer Roseible-GT (yield over 365 days of the 4th lactation – 27388 kg of milk with a fat content of 3.5%, milk fat yield – 958 kg) [14].

In 2010, the Holstein Association U.S. stated, a new world record at Ever-Green-View Farm (Waldo, Wisconsin, USA): cow number 1326 over 365 days of the 3rd lactation gave 32,765 kg of milk (an average of 89 kg per day) with a fat content of 3.86% and protein – 3.12%. The productivity of this cow exceeds the previous world achievement by 1934 kg of milk (6.26%) [15].

The milk productivity of a cow to a certain extent depends on its body weight, since the body weight is an indicator of general development and expresses the well-nourished degree an animal. Usually, in those farms where the largest amount of milk is obtained, the average body weight of cows is significantly higher than in other farms raising the same breed [16, 17]. -

Animals constitutionally predisposed to milk production show higher correlation dependence.

The breeding work with the Holstein breed is characterized by ensuring the health, longevity and high reproducibility of stud bulls and high-production cows, as well as intensive culling of low-production animals at an early age.

In terms of duration of use the record cows slightly exceed ordinary cows, but do not survive to the 4th calving. The maximum indicator of productive longevity (3.9 lactations)

was distinguished by cows with a mild yield of 11000-12000 kg. Further increase of milk to record lactation leads to the reduction of duration of productive use and lifelong milk yield [18].

2. Materials and Methods

The study was carried out on the basis of the breeding farm for breeding domestic range beef cattle the Lenintsy Agricultural Complex of Maisky District of Kabardino-Balkaria, based on the analysis of data on herd record cows. The study includes data on the 141 record cows, which were distributed by age and milk yield into three groups: the first included first-calf heifers with a milk yield of 6000 kg or more over 305 days of lactation, the second included cows of the 2nd calving with a milk yield of 6500 kg or more and the third – with a milk yield of 7000 kg or more taking into account the origin of the father. All the analyzed livestock was part of the breed core for 2019 and represented the best part of the herd.

3. Discussion

The distribution of record cows by age and milk yield over the first 305 days of lactation (Table 1) indicates that out of 141 heads, 125 (88.7%) are cows of the first four lactations and only 16 heads (11.3%) are 5 calving cows and older. The dynamics of milk yield increase with age is clearly traced to the third lactation and subsequently stabilizes at the level of 7500-7600 kg. At this stage, in a herd of cows there are 54 heads giving 7-8 thousand – 54, and 15 heads – 8-10 thousand. It is noteworthy that the average milk yield of the best 25 first-calf heifers was 6390.6 kg.

TABLE 1: Age distribution of record cows

Indicator	Age in lactations							Total
	I	II	III	IV	V	VI	VII	
Number of cows, heads	25	45	31	24	8	6	2	141
%	17.7	31.9	22.0	17.0	5.7	4.3	1.4	100
Average milk yield over 305 days	6390.6	7188.3	7568.6	7671.4	7584.3	7610.7	7982.0	-

According to the results of the study, the intense distribution of first-calf heifers subsequently negatively affects the duration of their use. In our opinion, this is also associated with the decrease in the age of the first calving. With insemination of heifers at 14-15 months and with calving at the age of 24 months, the first-calf heifers are

quite sensitive to intense milking, since they are still under the development stage. When energy is scarce in the first phase of lactation, they intensively use the body's nutrient reserves for milk, quickly exhaust, while reducing fertility and stress resistance. Such phenomena more often happen during summer pasture at free-range method of the entire livestock. As a rule, more highly sensitive cows, especially young ones, are physically less developed, get fed, and then they are not always, according to the residual principle, infringed on during pasture and watering by more physically strong species, which must also be taken into account.

In this regard, we suggested that the cattle management shall be divided into two sections and distributed taking into account age, milk and lactation phase, which will minimize costs. The intensity of milking of first-calf heifers is established taking into account the body weight and condition at the rate of not more than 1000 kg per 100 kg of the body weight.

The analysis of the effect of bulls on the nature of age-related variability in the productivity of daughters represents a significant selection interest (Table 2). The comparative assessment of bulls by the degree of increase in the milk yield of daughters from the first to the second lactation differs several fold. Thus, this difference between the extreme options was 731.6 kg, i.e. three times more (daughter of Iman bull 314 – +1096.5 kg, Arzamas 8815 – +364.9 kg).

The highest gain to the age of 3 calving periods and older in comparison with the first was given by the daughter of Torpan 2739 – 1076.1 kg and Twist 76849 – 1002.8 kg. The minimum gain of +557.0 kg was noted for the daughters of Kulon 1237. Besides, it is interesting to note that the daughters of these bulls gave the same milk yield in the first lactation. The latter indicates the possibility of selection by the degree of predisposition to milking with age of the offspring of different bulls.

As noted above, the intensive use of the Holstein cattle gene pool created the problem of sharp reduction of productive duration in almost all domestic breeds. In this regard, the study of the duration of use of high-production cows-daughters of different bulls presents practical and selection interest. The analysis showed (Table 3) that of the 141 record cows 71 (50.4%) were cows of 3 calving periods and older. Besides, on average the maximum milk yield – 7671.4 kg was obtained for the 4th lactation, for the 5th – 7610.7, and the milk yield of Goddess 9603 (father Rubin 11960925) for the 7th and Klapa 1042 for the 8th lactation amounted to 8159 and 7805 kg, respectively.

At this stage, the herd has 5 cows with the milk yield over 305 days of lactation from 9026 to 9712 kg, of which 3 are the daughters of Torpan 2739 and two of Tibul 3728 and Rubin 11960925 each.

TABLE 2: Age variability of the milk yield among record cows

Bull name and number	I calving – 6000 kg and more			II calving – 6500 kg and more			III calving – 7000 kg and more			Total		Milking age variability		
	n	M±m	σ	n	M±m	σ	n	M±m	σ	n	%	II to I	III to I	III to II
Torpan 2739	6	6587.7	571.5	26	7201.4	668.5	32	7663.8	639.4	64	45.4	+613.7	+1076.1	+462.4
Grillage 6977	1	6612.2	-	5	7212.7	218.8	16	7591.0	433.0	22	15.6	+600.5	+978.8	+378.3
Arzamas 8815	1	6750.6	-	2	7115.5	-	4	7433.3	513.4	7	5.0	+364.9	+682.7	+317.8
Knor 45026	7	6209.9	256.6	-	-	-	-	-	-	7	5.0	-	-	-
Iman 314	3	6502.3	-	2	7598.8	-	-	-	-	5	3.5	+1096.5	-	-
Gir 1883	2	6302.2	-	5	7029.4	407.4	1	7189.1	-	8	5.7	+727.2	+886.9	+159.7
Twist 76849	1	6553.6	-	2	6930.5	-	3	7556.4	-	6	4.2	+376.9	+1002.8	+625.9
Tibul 3728	3	6404.7	-	-	-	-	-	-	-	3	2.1	-	-	-
Kulon 1237	1	6527.1	-	1	6926.7	-	1	7084.1	-	3	2.1	+399.6	+557.0	+157.4
Rubin 11960925	-	-	-	-	-	-	3	7817.4	-	3	2.1	-	-	-
Rosti 8496680	-	-	-	-	-	-	3	7426.3	-	3	2.1	-	-	-
Valter 11435241	-	-	-	2	7405.4	-	1	8969.0	-	3	2.1	-	-	+1563.6
Topaz 1239	-	-	-	-	-	-	3	7293.5	-	3	2.1	-	-	-
Imker 4467	-	-	-	-	-	-	2	7667.8	-	2	1.4	-	-	-
Vals 5078	-	-	-	-	-	-	1	7279.4	-	1	0.7	-	-	-
Kandyi 119105	-	-	-	-	-	-	1	7283.7	-	1	0.7	-	-	-
Total:	25	6390.6	751.9	45	7188.3		71	7603.6		141	100.0	+797.7	+1213.0	+415.3

TABLE 3: Age distribution of record cows

Bull name and number	Age distribution of record daughter cows (lactation)													
	I		II		III		IV		V		VI		VII and older	
	n	M±m	n	M±m	n	M±m	n	M±m	n	M±m	n	M±m	n	M±m
Torpan 2739	6	6587.7	26	7201.4	18	7645.5	12	7794.7	1	7498	-	-	1	7805.0
Grillage 6977	1	6612.2	5	7212.7	3	7405.3	6	7715.2	3	7874.3	4	7329.3		
Arzamas 8815	1	6750.6	2	7115.5	4	7433.0								
Knor 45026	7	6209.9												
Iman 314	3	6502.3	2	7598.8										
Gir 1883	2	6302.2	5	7029.4	1	7189.0								
Twist 76849	1	6553.6	2	6930.5	2	7647.0			1	7374.0				
Tibul 3728	3	6404.7												
Kulon 1237	1	6527.1	1	6926.7			1	7084.0						
Rubin 11960925							1	8275.0	1	7018.0			1	8159.0
Rosti 8496680							1	7304.0	1	7597.0	1	7378.0		
Valter 11435241			2	7405.4							1	8969.0		
Topaz 1239					2	7409.0	1	7061.0						
Imker 4467					1	7760.0	-	-	1	7574.0				
Vals 5078							1	7279.0						
Kandyi 119105							1	7283.0						
On average	25	6390.6	45	7188.3	3	7568.6	24	7631.4	8	7584.3	6	7610.7	2	7987.0

At the same time, it is interesting that from the offspring of 10 stud bulls of the red-and-white Holstein breed, only 32 daughters fell into the group of record cows of three calving periods and older, 16 of which turned out to be the daughters of Grillage 6977, exactly as much as the recorders from 9 other bulls of the red-and-white Holstein breed.

The analysis of the offspring of stud bulls of the red-and-white Holstein breed indicates that their daughters – crossbreed cows do not show the ability to milking and their productivity is within the average milk yield of the herd.

4. Conclusion

In conclusion it can be noted that the use of Torpan 2739 Red Danish stud bull to improve the domestic red steppe breed gave a greater breeding effect than all 10 stud bulls of purebred red-and-white Holstein breed combined. We consider it advisable to further use the sperm of the stud bull Grillage 6977 to improve the technological qualities of the red steppe breed.

In the coming years, the task is to stabilize the herd at 7,000 kg, the herd has this potential. Against the background of maintaining and consolidating the average productivity and productive use of cows of the improved red steppe breed of at least 4 lactations, we plan to conduct deeper studies to analyze the ability of crossbreeds with red-and-white Holstein breed for age milking.

References

- [1] Gabaev, M. S. and Gukezhev, V. M. (2016). Reliability of Breeding Assessment of Cows by Milk Yield for the First 305 Days of Lactation. *International Scientific Research*, vol. 3, issue 28, pp. 266-268.
- [2] Velikzhanin, V. I. (2000). *Methodological Recommendations on the Use of Ethological Features in the Selection of Dairy Cattle*. St. Petersburg: Publishing house of VNIIRGZh, p. 19.
- [3] Velikzhanin, V. I. (2004). *Genetics of Behavior of Farm Animals (Ethology, Temperament, Productivity)*. St. Petersburg: Publishing house of VMII, p. 204.
- [4] Abylkasymov, D. A. (2011). Evaluation of Lactation Activities of Cows. In *Material of the Scientific and Practical Conference: Organization of Innovation Activities in Regional Agro-Industrial Complex*, Tver: OOO "SFK-office" (Tver) pp. 220-224.
- [5] Strekozov, N. I. (2008). Dairy Cattle Breeding in Russia: Present and Future. *Zootechnics*, vol. 1, pp. 18-21.

- [6] Amerkhanov, K. A., et al. (2012). Features of Dairy Cattle Breeding in the Russian Federation. *Dairy and Meat Cattle Breeding*, vol. 1, pp. 15-18.
- [7] Bilkov, V., Anishchenko, N. and Churbakov, Y. (2011). Intensification of Lactation Activities and Productive Longevity of Cows in High-Production Herds. *Dairy and Meat Cattle Breeding*, vol.8, pp. 11-12.
- [8] Miglior, F., et al. (2005) Selection Indices in Holstein Cattle of Various Countries. American Dairy Science Association. *J. Dairy Sci* vol.88, pp. 1255-1263.
- [9] Prokhorenko, P. (2013). Holstein Breed and Its Impact on the Genetic Productivity Progress of White-and-Black Cattle of European Countries and the Russian Federation. *Dairy and Meat Cattle Breeding*, vol. 2, pp. 2-6.
- [10] Seltsov, V. I. and Sermyagin, A. A. (2014). Assessment of Persistence Components of Milk from Simmental Cows-Heifers of Different Origin. *Russian Journal of Agricultural and Socio-Economic Sciences*, vol. 36, issue 12, pp. 3-8.
- [11] Berezina, T. I. (2013). Influence of the Method of Maintenance and Type of Physique of Black-And-White Cows on Milk Productivity. *Zootechnics*, vol. 2, pp. 21-24.
- [12] Diggins, R. V. (1984). Dairy Production. In *Prentice Hall, Inc, Englewood Cliffs* (5th ed.). New Jersey, USA: Prentice Hall, pp. 51-66.
- [13] Alekseev, A. L. Yudin, A. L. (2000). Relationship between the Behavior and Productivity of First-Calf Heifers. In *Proceedings of Scientific New Adaptive Technologies for the Production of Agricultural and Livestock Products*. December, Miass, Russia, Chelyabinsk: Geokontur, pp. 205-208.
- [14] Gavrilenko, N. S., Polupan, Y. P. and Sokhatsky, P. S. (1998). Chronology of Improvement of Holstein Dairy Cattle. *Zootechnics*, vol. 10, pp. 30-31.
- [15] Yanchukov, I., Matveeva, A. and Lavrukhina, A. (2011). Horizons in Dairy Breeding. *Dairy and Meat Cattle Breeding*, vol. 1, pp. 10-11.
- [16] Daniel, Z. (2009). Caraviello Length of Productive Life of High Producing Cows. *Dairy Updates Reproduction and Genetics*, vol. 612, pp. 1-8.
- [17] Ruziboev, N. R. (2014). Dependence of Dairy Productivity of Cows on their Living Mass. *Dairy and Meat Cattle Breeding*, vol. 4, pp. 32-34.
- [18] Vakhoneva, A., Abylkasymov, D. A. and Sudarev, N. I. (2010). Use in the Herd of Record Cows and their Longevity. *Dairy and Meat Cattle Breeding*, vol. 8, pp. 9-11.