

THE INFLUENCE OF THE FACTOR “MILK YIELD DURING THE FIRST LACTATION” ON CONTROLLED SIGNS OF PRODUCTIVITY AND DURATION OF ECONOMIC USE OF COWS OF THE YAROSLAVL BREED AND ITS CROSSBREDS WITH HOLSTEIN

N. M. Kosyachenko¹, A. V. Konovalov³, E. A. Pivovarova², M. A. Senchenko¹,
M. P. Petrović⁴, M. M. Petrović⁴, V. C. Petrović⁴

¹Yaroslavl State Agricultural Academy, Department of Biotechnology, 150042 Yaroslavl, Russia

²Yaroslavl State Agricultural Academy, Department of Zootechnics, 150042 Yaroslavl, Russia

³Yaroslavl Scientific Research Institute of Livestock and Fodder Production, 150517 Yaroslavl, Russia

⁴Institute for Animal Husbandry, 11080 Belgrade, Serbia

senchenko@yarcx.ru

The Yaroslavl region is a highly developed agricultural region of the Russian Federation. The level of milk production and the duration of the economic use of animals are the basics of success of leading dairy cattle breeding. These are indicators of biological and economical. Create of highly productive herds and increasing the span of the economic use of animals and lifetime productivity are the necessary goals of the intensification of dairy farming of the region. Therefore, the aim of our research was to determine the influence of milk yield during the first lactation on the controlled productivity signs and duration of the economic use of Yaroslavl breed of cows and its hybrids with Holstein. For statistical data have used the procedure generalized linear models (GLM) while in determining the strength of the influencing factor MATLAB 2000. Likewise, the assessment of phenotypic variability was performed using the multivariate analysis of variance. Our study has revealed that occur dependence between controlled signs and the factor milk yield during the first lactation.

Key words: cattle; genetic potential; paratypic factors; duration of the economic use; lifetime productivity

ВЛИЈАНИЕ НА ФАКТОРОТ „ПРИНОС НА МЛЕКО ВО ТЕКОТ НА ПРВА ЛАКТАЦИЈА“ ВРЗ КОНТРОЛИРАНИТЕ ЗНАЦИ НА ПРОДУКТИВНОСТА И ДОЛЖИНАТА НА ЕКОНОМСКОТО ИСКОРИСТУВАЊЕ НА КРАВТЕ ОД ЈАРОСЛАВСКАТА РАСА И НЕЈЗИНИТЕ МЕЛЕЗИ СО ХОЛШТАЈН

Нивото на производството на млеко и должината на економското искористување на животните се основа на успехот при одгледување на водечките млечни раси говеда. Тоа се биолошките и економските показатели. Создавањето на високопродуктивни стада и зголемувањето на периодот на економско искористување на животните и долгорочната продуктивност се неопходна цел за интензивирање на млекарството односно млечната индустрија. Целта на нашето истражување беше да се утврди влијанието на приносот на млеко во текот на првата лактација врз продуктивноста на испитуваните својства и должината на економската употреба на јарославската раса крави и нејзините мелези со расата холштајн. За статистичката обработка на податоците, се користени постапките на генерализираниот линеарен модел (ГЛМ), додека при одредување на јачината на влијанието на факторот е користен МАТЛАБ 2000. Процентата на фенотипската варијабилност е изведена со користење на мултиваријациона анализа на варијанса. Нашата студија откри дека постои зависност помеѓу контролираните својства и приносот на млеко во текот на првата лактација. Приносот на млеко во текот на првата лактација е во позитивна корелација со должината на економското искористување и долговечноста.

Клучни зборови: говеда; генетски потенцијал; паратипски фактори; должина на економско искористување; животна продуктивност

INTRODUCTION

Among factors affecting the rate of productive longevity of dairy cattle in the herd, the level

of cow's milk production during the first lactation deserves special attention. To get successful combination of indicators of cow's reproductive ability, high productivity and long period of economi-

cal use is possible if create favorable conditions for animals and prevent very early coverage of heifers (Kuznetsov, 1983, 2000; Malyukova, 2012). Positive phenotype correlation of milk yield indexes during the first lactation, length of the economical use and lifelong milk yield ($r = 0.13 - 0.58$) allowing scientists and professionals to predict the future yield of heifers during the first lactation (Kosyachenko, 2009; Konovalov & Malyukova, 2014; Kosyachenko et al., 2012; Kosyachenko et al., 2015a). Some authors considered that there is a positive correlation between the productivity during the first lactation (5000 kg and above) of cows of Simmental, Black-and-white, Lebedinsky, Ayrshire, Holstein, Swiss and other breeds and the span of economical use of cows (Minasian et al., 2015; Sawa, 2001). The milk production of the best dairy farms in such regions of Russian Federation which is being observed for the last decades are due to the genetic progress. At the same time, the use of a lactating cow is normalized resulting in healthy livestock and maximized profitability of milk production (Mikhailenko, 2015). The nutritional and environmental factors affect the degree to which genetic potential for milk production are expressed by cattle breeders (Miciński et al., 2008). At the same time, some scientists believe that intensive milking of heifers lead in declining of the span of their productive use and may result in reducing the terms of their economical use due to heavy loads on the developing organism (Kosyachenko et al., 2015a; Kosyachenko et al., 2015b). The result is a strain of the organism, metabolic disorders, reduction of natural resistance of animals, especially conditions of poor feeding, housing and health protection.

The study aim was to determine the influence of milk yield of Yaroslavl breed of cows during the first lactation on the controlled productivity signs and length of its economical use.

MATERIAL AND METHODS

The material prepared by Information database of the Yaroslavl cattle breed with the state registration № 2013620064, the program data of ARMZS (up to 2009 year) and ARMS-W (№ of the state registration is 2009613920 from 22. 07. 2009 year) and the information software module "PAVKA". The farms in the Yaroslavl region with different keeping technology were selected for study of such as: LLC breeding plant "Rodina" (Loose – boxed keeping of cows and equipment of

"Westfalia" company); the Joint Stock Company which is a breeding farm named after Dzerzhinsky (a captive keeping with the use of installations of "DeLaval" company).

The objects of the research were purebred cows of Yaroslavl breed and crossbred cows of the Holstein – Yaroslavl breed having dissimilar with thoroughbred Holstein. In the amount 4776, of them are 384 leavers. The breeding farm named after LLC breeding plant "Rodina" have 1620 cows and 2772 from breeding farm named after Dzerzhinsky). We determined the realization of the genetic potential estimated on controlling grounds. The procedure of generalized linear models (GLM) used for the statistical data, the determination of the strength of influence of factors procedure in the complex have performed by MATLAB 2000.

RESULTS AND DISCUSSION

In accordance with the method of the work we studied the effect of milk yield level of the first lactation on the duration of economic use in regard to different technologies (Table 1, Figure 1).

The duration of use, days was better in captive keeping with the use of installations of "DeLaval" company than that on loose-boxed keeping of cows and equipment of "Westfalia" (Table 1). In Loose-boxed keeping of cows, the implementation of the genetic potential for the duration of use, were better in Loose-boxed keeping of cows at first lactation milk yields; 2001–2500 kg (126%), 2501–3000 kg (115.9), 5501–6000 kg (82,5%). On the other hand, it performed better on captive keeping in the implementation of genetic potential of duration of use for the first lactation milk yields of 3001–3500 kg (104.9%), 35001–4000 kg (102.2%), 4001–4500 kg (100.5%, 4501–5000 kg (92.3%), 5001–5500 kg (90.1%), 6001–6500 kg (76.3%), 6501–7000 kg (89.9%). The lifetime milk yield was mostly higher in captive keeping than loose-boxed keeping of cows. The implementation of the genetic potential of lifetime milk yield,% were better in loose boxed keeping of cows at first milk yield lactation of 2001–2500 kg (90.8%), 2501–3000 kg (92.4%), 4501–5000 kg (117.9%), 5001–5500 kg (113.5%), 5501–6000 kg (123%), 6001–6500 kg (93%) while the captive keeping of cows were better in the implementation of the genetic potential of lifetime milk yield, at first milk lactation yield of 3001–3500 kg, (111.5%), 3501–4000 kg (119.1%), 4001–4500 kg (125.5%), 6501–7000 kg (113.7%).

Table 1

The dependence of the duration of the economic use and productive longevity on the value of milk yield during the first lactation

Milk yield during the first lactation	Technology of the keeping cows, Index	Loose - boxed keeping of cows and equipment of "Westfalia"	Captive keeping with the use of installations of "DeLaval» company"
2001–2500	The number of cows	227	271
	The duration of use, days	2814	2921
	The implementation of the genetic potential of the duration of use, %	126.0	98.8
	The lifetime milk yield, kg	13249	13156
2501–3000	The implementation of the genetic potential of lifetime milk yield, %	90.8	85.5
	The number of cows	219	368
	The duration of use, days	2630	2943
	The implementation of the genetic potential of the duration of use, %	115.9	99.7
3001–3500	The lifetime milk yield, kg	13444	13874
	The implementation of the genetic potential of lifetime milk yield, %	92.4	90.5
	The number of cows	199	268
	The duration of use, days	2287	3066
3501–4000	The implementation of the genetic potential of the duration of use, %	98.4	104.9
	The lifetime milk yield, kg	13469	16302
	The implementation of the genetic potential of lifetime milk yield, %	92.7	111.5
	The number of cows	162	161
4001–4500	The duration of use, days	2264	3006
	The implementation of the genetic potential of the duration of use, %	97.3	102.2
	The lifetime milk yield, kg	15570	17421
	The implementation of the genetic potential of lifetime milk yield, %	109.2	119.1
4501–5000	The number of cows	130	80
	The duration of use, days	2077	2963
	The implementation of the genetic potential of the duration of use, %	88.6	100.5
	The lifetime milk yield, kg	16264	18493
5001–5500	The implementation of the genetic potential of lifetime milk yield, %	114.3	125.5
	The number of cows	109	44
	The duration of use, days	2109	2728
	The implementation of the genetic potential of the duration of use, %	90.3	92.3
5501–6000	The lifetime milk yield, kg	16768	16585
	The implementation of the genetic potential of lifetime milk yield, %	117.9	111.3
	The number of cows	110	31
	The duration of use, days	1894	2661
6001–6500	The implementation of the genetic potential of the duration of use, %	80.5	90.1
	The lifetime milk yield, kg	16180	16433
	The implementation of the genetic potential of lifetime milk yield, %	113.5	110.1
	The number of cows	65	17
6501–7000	The duration of use, days	1928	2428
	The implementation of the genetic potential of the duration of use, %	82.5	82.2
	The lifetime milk yield, kg	17630	15233
	The implementation of the genetic potential of lifetime milk yield, %	123.0	101.9
6001–6500	The number of cows	55	8
	The duration of use, days	1604	2251
	The implementation of the genetic potential of the duration of use, %	68.3	76.3
	The lifetime milk yield, kg	13423	13482
6501–7000	The implementation of the genetic potential of lifetime milk yield, %	93.0	76.3
	The number of cows	54	5
	The duration of use, days	1607	2651
	The implementation of the genetic potential of the duration of use, %	68.5	89.9
6501–7000	The lifetime milk yield, kg	12043	16989
	The implementation of the genetic potential of lifetime milk yield, %	83.2	113.7

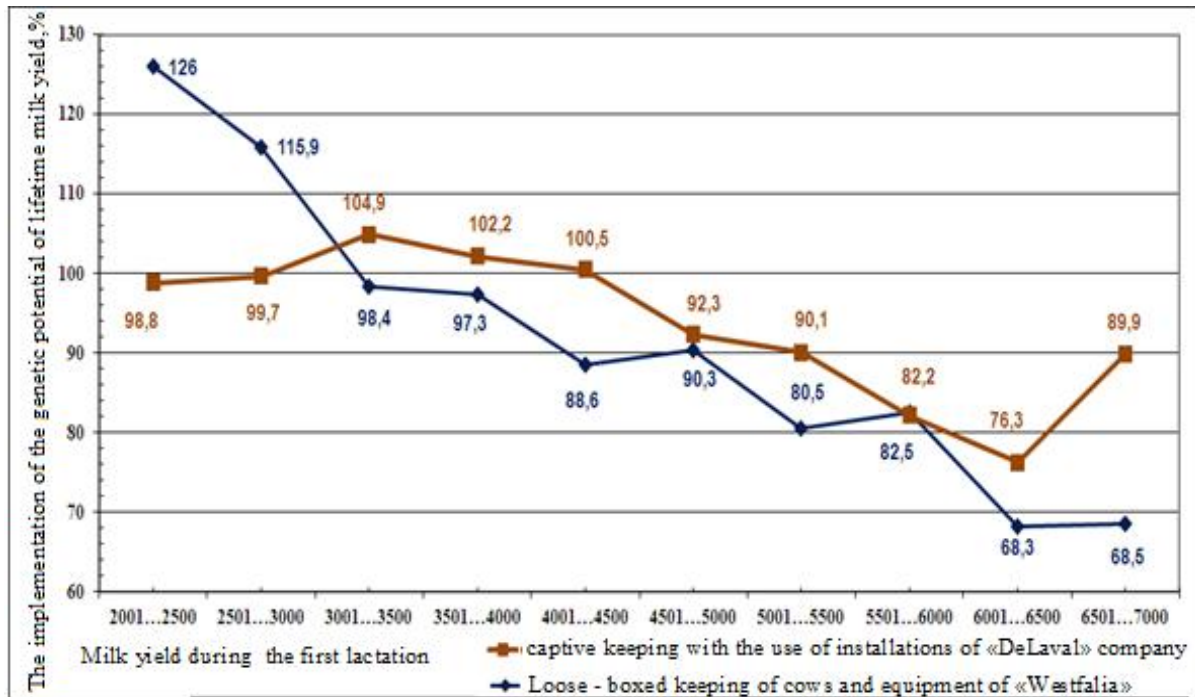


Fig. 1. The realization of genetic potential for the duration of economic use in the context of gradations of the factor “milk yield during the first lactation”

Our results (Figure 1) show that the regression curves are close to linear without clearly defined points of optimum. The confirmed results were the outcome of the factor analysis of such as; the effect of the interaction was 11.6*, the capacity of influence milk yield during the first lactation 19.3*, technology – 21.1*, disorganized factors – 48.0***. In our study, the high influence of the disorganized factors is due to the elements of a selection pressure (culling, etc.). In the information Table (1) it can be seen that from the boundary points of a selection pressure (it is at the level of 3000–3500 kg) the characteristic of regression lines for the trend of “decrease-increase” is almost identical. The coefficients of phenotypic correlation between the first milk yield lactation and lifetime productivity were +0,36*** in LCC breeding factory “Rodina” and in JSC breeding factory “Dzerzhinsky” +0.38. Additionally performed analysis of the power of the influence of factors showed the maximum influence of disorganized factors – 52.3***, the effect of the interaction is in second place – 24.1**, the power of influence of the factor “yield during the first lactation” was 15.9*, “technology” – 7.7*.

A high milk yield in the first lactation may be associated with significantly shorter lifespan and productive life (Janus et al., 2012), as well as their high yield for the first lactation positively influ-

ences their life performance (Anna Sawa, 2001). The findings of later authors complement with the result obtained in this research. The result of our study agreed with Jenko et al., (2015), noted that lifetime milk production (LMP) and productive life (PL) are nearly identical traits and performing selection in one measure will increase the genetic values of the other measure”. We also agree with Miciński & Pogorzelska, (2008), in their notes indicating that milk yield in the first lactation may offer a basis for selecting high-performance cows.

CONCLUSIONS

With an intensive use of animals to a certain level, milk yield during the first lactation is positively associated with the duration of economic use and productive longevity (in our case, this level of milking is 4001 – 4500 kg of milk). It can perceive that with further increase of milk yield, is a reduction in the duration of use by 2.68–6.28% with increasing of productive life by 1.4–7.08%.

Acknowledgments: Institute for Animal Husbandry (Belgrade, Serbia); FSBEI HE “Yaroslavl State Agricultural Academy” (Yaroslavl, Russia); Yaroslavl Research Institute of Livestock and Fodder Production (Yaroslavl, Russia); Fund of Assistance to Small Forms

of Enterprises in Science and Technology sphere in program "UMNIK – 2013" (Yaroslavl, Russia).

REFERENCES

- [1] Jenko J., Perpar T., Kovač M.: Genetic relationship between the lifetime milk production, longevity and first lactation milk yield in Slovenian Brown cattle breed. *Mljekarstvo*, **65** (2), 111–120 (2015).
- [2] Konovalov A., Malyukova, M.: The increasing of milk productivity of Yaroslavl breed cattle due to the increasing genetic potential under various keeping technologies. *Journal of Micro-biology, Biotechnology and Food Sciences*, 3 (special issue 2), 51–53 (2014).
- [3] Kosyachenko N.: ARMS-W Avtomatizirovannoe rabochee mesto selekcionera [ARMS-W Automated workplace breeder] (Certificate of the state registration of computer programs; reg. number 2009613920 from 22. 07. 2009) [in Russian].
- [4] Kosyachenko N., Konovalov, A., Furaeva. N.: Informacionnaja baza dannykh po Yaroslavskoi porode krupnogo rogatogo skota [Information database about the Yaroslavl breed cattle] (Certificate of the state registration of database reg. number 2013620064 from 13. 12. 2012) [in Russian] 2012a.
- [5] Kosyachenko N., Konovalov A., Nikolaeva E, Petrović M., Petrović M, Pantelić V.: The influence of the factor "genetic value of the father" on the implementation of the genetic potential of the indicator "milk production of maximum lactation" of the Yaroslavl breed cows. *Biotechnology in Animal Husbandry* / Institute for Animal Husbandry, Belgrade-Zemun, **31** (1), pp 145–151 (2015b).
- [6] Kosyachenko N., Konovalov A., Pivovarova E., Senchenko M.: The influence of the factor "live weight at the first calving" on controlled signs of productivity and duration of economic use of cows of the Yaroslavl breed and its hybrids with Holstein. *Book of abstracts. "4th International Congress. New Perspectives and Challenges of Sustainable Livestock Production"*, Institute for Animal Husbandry, Belgrade-Zemun. pp 504–512, 2015a.
- [7] Kuznetsov V.: *Osnovy nauchnykh issledovanii v zhivotnovodstve* [Basic research in animal husbandry]. Zonal Agricultural Research Institute of the North-East, p. 568 [in Russian], 2000.
- [8] Kuznetsov V.: *Ocenka geneticheskikh izmenenii v stadah i populyacijakh sel'skokhozhajstvennykh zhivotnykh* [Evaluation of genetic modifications in herds and populations of agricultural animals]. Guidelines, p. 44 [in Russian] 1983.
- [9] Malyukova M.: Realizacia geneticheskogo potenciala pozhiznennoi produktivnosti pri raznykh tehnologiyakh sodержaniya korov jaroslavskoj porody [The implementation of the genetic potential of life productivity with the use of various keeping technologies of the Yaroslavl breed cattle]. *Bulletin of the of AIC*, **2** (18), 92–95 (2012) [in Russian].
- [10] MATLAB 2000.
- [11] Miciński J., Pogorzelska J.: Effect of Inter-Calving Interval Duration on Cow Productivity in Two Consecutive Lactations, *Acta Sci. Pol., Zootechnica*, **7** (2) 11–22 (2008).
- [12] Mikhaïlenko I. M.: Productivity and herd reproduction. New Probabilistic Statistical and Dynamic Models to Control Life Cycle in Lacting Cows. *Agricultural Biology*, **50**, 4, 467–475 (2015).
- [13] Minasian L. M., Khechoyan A. R., Simonyan Kh., Chitchyan T. ZH.: Productivity of German Swiss Brown Cows in Conditions of "Agroholding-Armenia" Ltd Farm. *Annals of Agrarian Science*, **13**, 1 (2015).
- [14] Sawa A.: Effect of First Lactation Yield on Life Performance of Cows. *Electronic Journal of Polish Agricultural Universities*, **4** (2), 2 (2001).