УДК 636.22/28.081.14

DEPENDENCE OF DAIRY PRODUCTIVITY COWS OF UKRAINIAN RED-AND-WHITE DAIRY BREED ON GENOTYPIC AND PARATYPIC FACTORS

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Researches to study the milk productivity dependence of Ukrainian Red-and-White dairy cows on genotypic and paratypic factors were conducted in the breeding farm PAE "Piskivske" Bakhmach district of Chernihiv region. The most representative five genotypic groups of animals divided by the conditional share of heredity of Holstein breed were studied: I - livestock with a share of blood 50.01-56.25; II - 56.26-62.50; III - 62.51-75.00 and IV - 75.01-87.50; V - 87.51% and <. By comparing different genotype groups of cows installed dependence of yield amount on conditional share of inheritance Holstein breed. With the growth conditional proportion of Holstein blood, milk yield increased during the evaluated first three and higher lactations. The high and reliable effect was found on the yield amount of cows firstborn by factors of birth (η_x^2 = 0.329) and calving (η_x^2 = 0.336). The share of birth and calving season influence on milk yield although insignificant but reliable and amounted to 3.7 and 5.3%, respectively. The value of milk yield of cows firstborn in the controlled herd greatly depended on the sire genotype (η_x^2 = 0.315), cow's conditional blood by Holstein breed (η_x^2 = 0.264), father breeding value (η_x^2 = 0.335) and mother cow's father (η_x^2 = 0.340), paternal (η_x^2 = 0.163) and maternal line (η_x^2 = 0.089). According to research results was substantiated expediency of monitoring selection information, identification and use of animal-specific patterns of leading traits development of milk productivity depending on the geno- and paratypic factors influence in the selection process of pedigree herd formation.

***Key words**: genotype, conditional blood, Ukrainian Red-and-White dairy, force of influence, milk productivity*
DOI: https://doi.org/10.32845/bsnau.lvst.2021.1.3

At the first stage of new Ukrainian dairy breeds creation, complex reproductive crossbreeding was used with application of both purebred Holsteins and breeding sires of domestic selection with different shares of heredity by Holstein breed. In the process of improving the huge variety of crossbreed cow population in the direction of consolidation, the priority in selection was given not to the conditional proportion of blood by any of the original breeds, and expression in animals of the desired breed type [5, 6, 13].

Over time, due to the lack of sires of their own selection, a crossbreeding system was used according to the method of open population, i.e. with the dominant use of sires Holstein breed of foreign selection. Thus, gradually varied number of hybrid livestock Ukrainian Red-and-White dairy breed was absorbed by the gene pool of Holstein [16]. As for effectiveness of this measure, there are different opinions and ambiguous research results.

For example, staff of the Institute of Animal Breeding and Genetics [15] proved that for firstborns of Ukrainian Red-and-White dairy breed, displacement of the original maternal

material by parent, in particular Holstein breed, was effective and accompanied by increased milk yield for rising blood in genotype from 50.01% to 87.49%. At the same time, increase in blood content for Holstein breed to 87.5% and more was accompanied by an insignificant - 21 kg, but a decrease in the yield firstborns. According to the data of higher lactation, the largest amount of milk was obtained from cows of Ukrainian Red-and-White dairy breed, the share of conditional blood of which by Holstein breed was 50.01–75.00%. The increase of Holstein breed inheritance in cow's genotype of Ukrainian Red-and-White dairy breed led to a decrease in milk yield for higher lactation

When studying indicators of lifetime productivity of cows Ukrainian Red-and-White dairy breed depending on the conditional heredity of Holstein, authors [19] found that the highest lifetime yield was found in crossbreed animals with conditional blood 21.5-50.0% (10321 ± 825.7 kg). In animals with conditional Holstein blood above 87.5%, lifetime yield was reliably lower (8053 ± 506.7 kg).

When comparing group of cows Ukrainian Red-and-White dairy breed with Holstein blood <62.5% LLC "Mena-Avangard" Chernihiv region, with peers from blood 62.6-75.0%, advantage was 301 kg in favor of the latter with reliable difference in P <0.01. A subsequent increase in blood content to 75.0–87.5% led to corresponding rise in milk yield by 262 kg (P <0.01), and higher-blooded animals with Holstein heredity above 87.6% outnumbered the previous generation with highly significant difference on 345 kg of milk at P <0.001 [14].

According to studies of cows Ukrainian Red-and-White dairy and Holstein breeds in the herd of experimental farm "Khrystynivske" taking into account the conditional blood for improving breed, there was a tendency to curvilinear increase in milk yield of firstborn with increasing conditional share of Holstein inheritance [20]. If the milk yield of cows firstborn with Holstein blood to 75% was 6305 ± 292.3 kg, then animals with blood 93.8–96.0% were 6632 ± 110.7 kg. According to the third lactation, this difference disappeared. The milk yield of adult cows with Holstein blood to 75% was 7167 ± 143.2, and cows with blood 93.8–96.0% were 6872 ± 209.9 kg.

Comparative analysis of milk productivity of cows Ukrainian Red-and-White dairy breed of different conditional blood by Holstein breed established a significant level of intergroup differentiation and specificity on the basis of milk productivity [8]. Thus, milk yield of cows for higher lactation with Holstein blood of 50.1… 74.9% amounted to 6071 kg, while cows with blood over 87.5% - 5688 kg.

Dairy productivity of cows Ukrainian Red-and-White dairy breed of controlled farms in the country of different conditional share of heredity of Holsteins (65-80%), met the requirements of target standards for the first and higher lactation and significantly exceeded requirements of "Provisions on testing of selection achievements" as by quantitative, and qualitative indicators of productivity for period 2013 [9].

When comparing the milk productivity of Red-and-White cows derived from breeding of 3/4 blood hybrids by Holstein "in itself" with their peers obtained by direct way with conditional blood of Holstein 75.0%, found that from hybrids by Holstein "in itself" they milked 6263.3 kg of milk for the first lactation, which was on 455.5 kg more than in direct hybrids [2].

In the aspect of influence of Holstein heredity on the development of economically useful traits of cows should be noted that use of Holstein gene pool accompanied by increasing demands of their high-blooded offspring to feeding and housing conditions and, consequently, to reducing productivity indicators [4, 7, 12, 17, 18].

In this regard, the question of assessing the degree of influence of heredity of improving breed on the development of traits of dairy productivity of cows required careful monitoring, as breeding work required reliable, objective and systematic analysis of selection situation over time, including identification of characteristic patterns of genotype in the specific conditions of breeding farm, taking into account which allowed to take appropriate measures to improve it.

The aim of research was to substantiate the effectiveness of reproductive crossbreeding and study the peculiarities of development of milk productivity of cows depending on the share impact of hereditary and paratypic factors in the selection process of breeding herd formation of Ukrainian Red-and-White dairy breed.

Materials and research methods. Experiments were conducted in a breeding farm for breeding Ukrainian Red-and-White dairy breed PAE "Piskivske" Bakhmach district of Chernihiv region. Research materials are based on retrospective analysis of selection information (Form 2-mol). The most representative five genotypic groups of animals divided by conditional share of Holstein breed heredity were studied: I - livestock with share of blood 50.01-56.25; II - 56.26-62.50; III - 62.51-75.00 and IV - 75.01-87.50; V - 87.51% and <.

Indices of selection (SI) and standardized breeding value (SBV) were calculated according to formulas used by the program SUMS "Orsek-SC" [3]. The selection index represented a numerical characteristic of hereditary qualities of animals by dependent levels of genotypic effects of traits that take into account their selection and economic significance.

Research materials were processed by methods of biometric and analysis of variance using software on a PC according to formulas given by E. K. Merkurevoi [11].

Research results. Analysis of cows dairy productivity traits, estimated for 305 days of the first-best lactation, proved the existence of milk yield value dependence on the conditional proportion of blood by Holstein breed, Table 1. Evaluating crossbreed genotypes of cows at the age of first lactation, we observe an increase in milk yield in experimental groups of animals with growth blood by Holstein. The difference in milk yield between the first and second groups was 383 kg with a reliability of P <0.01, between the second and third difference was slightly smaller - 273 kg (P <0.01), a significant increase in milk yield was observed in cows firstborn with conditional blood above by 75.0%. Domestic animals of the fourth group were better at milking compared to the third by 552 kg (P <0.001), and the fifth compared to the fourth - by 785 kg (P <0.001). About positive result of holsteinization of controlled herd convincingly evidenced by the difference in milk yield between the first (50.01-56.25%) and the fifth (87.51 and <) groups of cows firstborn, which amounted to 1993 kg (P <0.001).

With a slight variability of fat content in the milk of cows firstborn (3.72-3.78%), but a reliable difference of 0.07% (P <0.01), the fifth high-blooded group of animals was the best by milk fat yield (264.6 kg), which with a significant difference prevailed peer groups I-IV by 31.4-72.8 kg (P <0.001).

No significant milking of cows at the age of second lactation was revealed, but the regularity regarding the priority of

milked milk level in comparison with five crossbred animal groups remained. With each subsequent generation, milk yield increased by 405 (P <0.01), 289 (P <0.05), 663 (P <0.01) and 520 (P <0.01) kg with a corresponding increase in the heredity of improving breed.

According to the third lactation also observed a certain level of milking cows of crossbreed groups, with intergroup variability of difference of increasing of milk yield within 259-676 kg (P<0.05-0.001), with a predominance in milk yield of the fourth and fifth high-blooded by Holstein groups.

Table 1

Milk productivity of cows depending on the conditional share of blood for Holstein breed, (x ± S.E.)

№ gr.	Conditional blood, %	n	Milk yield, kg	C_V, %	% fat	C_V, %	kg of fat	C_V, %
First lactation								
I	50,01-56,25	98	5062±96,4	19,8	3,79±0,019	2,2	191,8±3,62	18,5
II	56,26-62,50	169	5445±87,9	24,6	3,79±0,011	3,6	206,3±3,56	25,4
III	62,51-75,00	177	5718±72,3	27,6	3,78±0,012	3,3	216,1±3,42	24,1
IV	75,01-87,50	114	6270±93,5	20,2	3,72±0,013	1,2	233,2±3,82	21,6
V	87,51 і <	212	7055±78,2	15,4	3,75±0,009	1,1	264,6±2,62	13,7
Second lactation								
I	50,01-56,25	81	5257±114,9	24,2	3,77±0,018	4,4	198,2±4,81	24,9
II	56,26-62,50	133	5662±101,4	26,5	3,75±0,021	6,3	211,0±4,19	27,2
III	62,51-75,00	154	5951±106,3	25,4	3,74±0,019	5,7	222,6±4,01	25,9
IV	75,01-87,50	94	6614±175,6	28,1	3,73±0,008	1,2	246,7±9,89	26,9
V	87,51 і <	198	7134±96,6	24,3	3,71±0,007	0,9	246,7±3,91	17,5
The third lactation								
I	50,01-56,25	72	5557±189,3	24,3	3,76±0,019	3,7	208,9±7,33	35,4
II	56,26-62,50	122	5816±147,2	21,2	3,74±0,012	3,2	217,4±5,52	20,5
III	62,51-75,00	123	6308±132,4	20,7	3,73±0,021	5,0	235,3±6,07	19,9
IV	75,01-87,50	62	6984±217,2	28,2	3,75±0,050	1,9	261,9±5,33	27,4
V	87,51 і <	156	7288±97,5	22,6	3,75±0,009	1,3	273,3±3,63	18,5
The best lactation								
I	50,01-56,25	81	6866±179,6	24,5	3,74±0,019	3,1	256,9±6,91	29,4
II	56,26-62,50	133	6947±129,4	20,9	3,74±0,008	1,9	259,8±4,65	21,6
III	62,51-75,00	154	7707±113,9	18,6	3,72±0,021	5,5	286,6±4,08	18,8
IV	75,01-87,50	74	7908±145,2	26,2	3,73±0,018	4,2	294,9±3,75	17,6
V	87,51 і <	198	8206±94,7	17,3	3,72±0,007	1,5	305,3±3,22	15,4

Analysis of sufficiently high indicators of milk yield for the best lactation coincided with data of the third, both in terms of average values advantage and degree of reliability. The milk yield of cows with a share of Holstein heredity 87.51 and more percent 8206 kg of milk was significantly higher than animals of the first-third groups, respectively, by 449-1340 kg (P <0.001).

Thus, when determining the influence of genotypic factors on the dairy productivity of cows in the controlled herd, it can be argued that one of them - conditional share of heredity, will certainly affect the amount of milk. Since there was no doubt that genetic potential of herds and breeds was created by sires, it is worth paying attention to this important selection aspect in terms of their genotype and origin.

Detailed analysis of the diversity of crossbreed genotypes of cows showed that in the herd used both reproductive and absorbing crosses. That is, in the selection we used Holstein's crossbred parents of their own selection and purebred Holstein sires.

Practice breeding proved that interbreed crossing in the early stages of its use gave corresponding positive effect by implementing the so-called "breed difference" [10], but further, with increasing in herds blood of improving breed, to enhance the efficiency of breeding should significantly increase selection requirements for sires.

In addition, it should be borne in mind that reproductive crossing of genotypically diverse animals, results in constant gene recombination and complex cleavage by quantitative traits, which interfere with the rapid formation of animals of the desired type, making the selection process long in time [1].

The efficiency of crossbreeding in the experimental herd increased significantly only after the use of purebred Holstein sires evaluated by the offspring quality, as evidenced by the level of cow's productivity in the fifth group. However, we can talk about a systematic and rational approach to the selection of bulls only conditionally, as over the past five years more than 20 sires have been used in the herd.

In the aspect of further study the question of effectiveness of dairy cattle breeding depending on the genotype and environmental conditions, it will be unreasonable to discuss which is more important - genotypic or paratypic factors. It did not make sense to contrast these two main factors that determine the progress of selection, bearing in mind that development of any of quantitative economically useful traits was the result of interaction of genotype and environment.

However, to determine the extent to which certain genotypic and paratypic factors affect the implementation of milk productivity traits of cows in the herd, it is important both from a theoretical and practical point of view.

To determine the degree of influence of genotypic and paratypic factors on the cows milk productivity of Ukrainian Red-and-white dairy breed in the herd of breeding farm "Piskivske" one-factor analysis of variance was performed, results of which are given in Table 2.

Table 2

Force of influence paratypic and genotypic factors on the cows milk productivity by data of the first lactation, (n = 578)

Indicator	Gradation's number	Yield		Fat, %	
		η_x^2	F	η_x^2	F
Year of birth	11	0,329	27,8	0,062	3,73
Birth season	4	0,037	7,28	0,002	0,35
Year of first calving	10	0,336	32,0	0,046	3,01
First calving season	4	0,053	10,8	0,022	4,29
Father's conditional blood	8	0,315	36,3	0,036	2,92
Cow genotype (conditional Holstein blood)	47	0,264	4,13	0,082	1,02
BV of cow's father	23	0,335	12,7	0,040	1,05
SI father of cow's mother	10	0,340	26,8	0,030	1,60
Father's line	8	0,163	15,1	0,017	1,38
Mother's line	6	0,089	9,50	0,016	1,57

The analysis of obtained coefficients of force influence of paratypic factors convincingly testified about high and significant effect on the milk yield volume of cows firstborn, factors year of birth (η_x^2 = 0.329) and calving (η_x^2 = 0.336). The share of influence of the birth and calving season on milk yield, although insignificant, but reliable and was 3.7 and 5.3%, respectively.When studying factors influencing the year and season, we meant that these factors alone cannot directly affect the rearing of heifers and their future milk productivity, but indirectly development of any quantitative trait depended on conditions created in a given year for rearing of young animals, as well as conditions of feeding and keeping of cows firstborn in a particular year of their calving.

Degrees of coefficients of influence force of paratypic factors on the fat content in milk indicated that this trait was not prone to significant variability due to changes in the year and season in which animals were born and lactated, because its variability was largely determined by heredity.

Indicators of variance analysis testified that amount of milk yield of cows firstborn in the controlled herd significantly depended on the sire genotype. The obtained high coefficient of force influence (η_x^2 = 0.315) confirmed by a similar level of reliability by Fischer criterion (F = 36.3) and was consistent with our previous conclusions.

In the same context, it should be noted that milk yield of cows by 26.4% also reliably depended on their conditional blood by Holstein breed.

Highly reliable indicators of the force influence of father's breeding value (η_x^2 = 0.335) and father of cow's mother (η_x^2 = 0.340) showed that these two categories of ancestors determine their milk productivity at almost the same level.

The efficiency and necessity of linear breeding can to some extent be substantiated by the highly reliable value of force of influence coefficient of father line on the milk yield of daughter descendants (η_x^2 = 0.163). The influence of cows belonging to the maternal line on milk yield was almost half less (η_x^2 = 0.089).

Thus, the established presence of genetic influence on the variability of cows firstborn milk yield testified to the effectiveness of breeding Ukrainian Red-and-White dairy breed by selection of ancestors with a high score on selection indices.

Conclusions. According to research results, was substantiated expediency of monitoring selection information, identification and use of animal-specific patterns of development of milk productivity leading traits depending on the influence of geno- and paratypic factors in the selection process of formation pedigree herd.

In the herd of cows Ukrainian Red-and-White dairy breed, was established influence of the conditional share of Holstein heredity on the amount of milk yield, the level of which increased significantly in high-blooded animals obtained from purebred Holstein sires.

The determined force of influence of conditional shares of heredity by Holstein breed of father and cow on milk yield indicators was quite high and amounted in the overall variability of this indicator for the first lactation, respectively, 31.5 and 26.4%.

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Залежність молочної продуктивності корів української червоно-рябої молочної породи від генотипових та паратипових чинників

Дослідження з вивчення залежності молочної продуктивності корів української червоно-рябої молочної породи від генотипових та паратипових чинників проводилися у племінному заводі ПСП “Пісківське” Бахмачського району Чернігівської області. Вивчались найбільш представницькі п’ять генотипових груп тварин розділених за умовною часткою спадковості голштинської породи: I – поголів’я тварин з часткою кровності 50,01-56,25; II – 56,26-62,50; III – 62,51-75,00 та IV – 75,01-87,50; V – 87,51% і <. Шляхом порівняння різних за генотипом груп корів встановлена залежність величини надою від умовної частки спадковості голштинської породи. Із збільшенням умовної частки крові голштинской породи зростав надій упродовж оцінюваних перших трьох та вищої лактацій. Встановлено високий та достовірний вплив на величину надою корів-первісток факторів року народження (=0,329) та отелення (=0,336). Частка впливу сезону народження та отелення на надій хоча незначні але достовірні й становили відповідно 3,7 та 5,3 %. Величина надою корів-первісток підконтрольного стада істотно залежить від генотипу бугая (=0,315), умовної кровності корови за голштинською породою (=0,264), племінної цінності батька (=0,335) та батька матері корови (=0,340), лінії батька (=0,163) та материнської лінії (=0,089). За результатами досліджень обґрунтована доцільність моніторингу селекційної інформації, виявлення і використання характерних для тварин закономірностей розвитку провідних ознак молочної продуктивності залежно від впливу гено- та паратипових факторів у селекційному процесі формування заводського стада.

Ключові слова: *генотип, умовна кровність, українська червоно-ряба молочна, сила впливу, молочна продуктивність*

Дата надходження до редакції: 25.01.2021 р.