

*Borshch A. A., Candidate of Agricultural Sciences,
Assistant of the Department of Technology Production of Milk and Meat*

Bila Tserkva National Agricultural University

*Ruban S. Yu., Doctor of Agricultural Sciences, Professor, Corresponding Member of the National Academy of Sciences of Ukraine, Head of the Department Genetics, Breeding and Biotechnology Animals
NUBiP of Ukraine*

INTENSITY OF CROSSBRIDGE HEIFERS UNDER DIFFERENT TECHNOLOGIES CONTENT

The use of cross-breeding as an element of improving livestock in commercial herds affected the growth and development of first-generation heifers compared to pure-blooded counterparts. The heifers of the Ukrainian black-rye dairy breed were characterized by higher live weight values compared to the Brown Swiss, while the heifers were obtained as a result of the crossing of the Monbeliarde breed with the Ukrainian red-rye milk breed; on the contrary, they were marked by a larger live weight than the red-rye ones. According to the indices that characterize the intensity of their growth and development, the heifers of Ukrainian black-rye milk breed had higher rates in all indices compared with their respective counterparts. In studies conducted on heifers of the Ukrainian red-rye dairy and Monbeliarde breeds, it was established that they were dominated by red-rye analogues by indicators of growth.

Key words: *crossbred, live weight, growth, growth rate, technologies content.*

Statement of the problem. Holsteinized cattle, along with many positive features, has a number of problems associated with lowering the level of reproduction, productive longevity, product quality [1, 2]. Crossbreeding is one of the methods for improving these dairy cattle characteristics in commodity herds [3, 4]. It represents a system of interbreeding, in which the offspring can expect higher rates of individual quantitative attributes than their parents due to their heterozygosity for many genes [5]. In the United States, among the breeding breeds for Holstein, the most common are Jersey, Brown Swiss, Ayrshire and Monbeliarde, and in the European Union and Scandinavia, Swedish, Norwegian and Danish reds [5–8].

Analysis of basic research and publications on this problem. Studies by foreign scientists found that in crossbred animals of the first generation, such functional features as productive longevity, qualitative composition of milk, reproduction rates [9, 10] significantly improved. At the same time, expenditures for veterinary medicines decreased by 9.4 %, the duration of the service period decreased by 26 days, and the duration of productive use increased by 26 % [11, 12]. Therefore, the use of this breeding method would be useful also at domestic commercial farms using Ukrainian breeds. The main indicators of development of young animals under different technologies of exploitation are the intensity of their growth and live weight during the period of cultivation [13]. It is known that in the process of growth and development of animals, the intensity of metabolic processes decreases with age, which is due to the biological features of the organism [14]. There is a belief that live weight does not fully reflect the intensity of animal growth by age [15]. The most important indicator, the size of which can be characterized by the intensity of animal growth, is the average daily gain of living weight.

The purpose of the research was to analyze the dynamics of live weight, average daily increments and the intensity of growth of crossbred heifers compared with pure-parent analogues for different maintenance technologies.

Materials and methods of research. The research was conducted at the STOV OP «Mikhailivske» in village Mykhailivka (49°11'52" N, 28°43'29" E) Vinnitsa district of Vinnitsa region on heifers of Ukrainian black-rye milk breed and first-generation heifers obtained as a result of crossing with Brown Swiss breed and at «Azorel Ltd.» in village Muhivtsi (48°57'01" N, 28°47'09" E) Nemyriv district of Vinnitsa region on the cows of the Ukrainian red-rye dairy breed and their first-generation breeding with the Monbeliarde breed. In the «Mikhailivske» station there is an attachment-stall system of maintenance in the winter and uncoupled with maintenance on the playgrounds in the spring and autumn periods. In «Azorel» LLC, the non-binding content is used with the use of a deep, long-changeable litter. In both farms there were formed two groups of pure-breeding and domestic heifers-analogues with a number of 25 («Mikhailivske») and 20 («Azorel» LLC) heads in each. Studies were conducted from birth to 18 months of age.

In both farms, the same type of annual feeding of cows with full-fodder mixed fodders is used.

During research, live birth weight was recorded on a monthly basis, daily average increments, indices characterizing the growth and development of animals. The decay of the relative growth rate of heifers and the growth rate index of energy were determined by Yu. K. Svechina and L. I. Dunaieva [16]. Indicators of the intensity of animal growth – according to Yu. K. Svechina [17] and V. P. Kovalenko [18].

Research results. As a result of the conducted researches it was established that during all age periods the heifers of Ukrainian black-rye milk breed were characterized by higher rates of live weight compared to Brown Swiss pests and at 18 months of age the difference was 14.34 kg, while the heifers were obtained as a result of crossing. On the contrary, the Monbeliarde breed with the Ukrainian red-rye milk breed was marked by a higher live weight than the red-rumped ones, and at the 18th month their live weight was 15.23 kg (table 1).

1. Live weight of investigated breeds heifers, kg

| Breed | Age periods, months | | | |
|--|---------------------|--------------|-------------|--------------|
| | at birth | 6 | 12 | 18 |
| Ukrainian black-rye dairy | 33,76±0,37 | 198,19±4,22 | 307,81±4,64 | 412,92±5,08 |
| ½ Ukrainian black-and-white milk x ½ Brown Swiss | 31,34±0,72** | 186,49±3,71* | 296,38±4,52 | 398,58±5,74 |
| Ukrainian red-rye dairy | 34,26±0,53 | 204,27±4,86 | 316,51±5,27 | 427,34±4,86 |
| ½ Ukrainian red-rye dairy x ½ Monbeliarde | 36,42±0,37** | 212,31±3,58 | 328,16±4,73 | 442,57±5,19* |

Note. *P<0,05; **P<0,01 compared to Ukrainian black- and red-rye dairy breed.

An important indicator of the growth of heifers is the multiplicity of increase in their live weight (table 2). It was established that, despite the lowest live weight at birth and at all ages, domestic heifers of Ukrainian black-rye milk and Brown Swiss breeds had the highest index of multiplicity of increase in live weight – 12.72 times (or 367.24 kg), whereas in pure-breed live weight analogues increased 12.23 times (or 379.16 kg). Local heifers of the Monbeliarde and Ukrainian red-billed milk among the studied breeds had the highest live weight at birth, but the multiplicity of increase in their live weight was the lowest – 12.15 times (or 406.15 kg), relative to the heifers of Ukrainian red-rye dairy breeds, then they have increased by 12.47 times (or 398.08 kg).

2. Multiplicity of increase in live weight heifers, times

| Breed | Age periods, months | | |
|--|---------------------|--------------|---------------|
| | 6 | 12 | 18 |
| Ukrainian black-rye dairy | 5,88±0,02 | 9,69±0,03 | 12,97±0,05 |
| ½ Ukrainian black-and-white milk x ½ Brown Swiss | 5,94±0,02* | 9,45±0,02*** | 12,71±0,04*** |
| Ukrainian red-rye dairy | 5,95±0,03 | 9,23±0,06 | 12,47±0,04 |
| ½ Ukrainian red-rye dairy x ½ Monbeliarde | 5,82±0,02*** | 9,01±0,07* | 12,15±0,05*** |

Note. *P<0,05; ***P<0,001 compared to Ukrainian black- and red-rye dairy breed.

The highest average daily increments among animals of all breeds were from birth to 6 months of age (table 3). Subsequently, up to the 18-month-old age, this figure was gradually declining. The largest daily average increments during the entire period of cultivation were in the range of Ukrainian red-rye breed and Monbeliarde – 752.19 g, and the smallest in the areas of the Ukrainian black-rye breed with Brown Swiss – 681.09 g.

3. Average daily gain of heifers during growing, grams

| Breed | Age periods, months | | | |
|---|---------------------|----------------|----------------|----------------|
| | 0–6 | 6–12 | 12–18 | 0–18 |
| Ukrainian black-rye dairy | 913,22±2,14 | 607,54±1,73 | 581,94±2,03 | 702,37±1,74 |
| ½ Ukrainian black-and-white dairy x ½ Brown Swiss | 861,95±1,72*** | 610,57±1,58 | 570,35±1,84*** | 681,09±2,06*** |
| Ukrainian red-rye dairy | 944,47±2,83 | 622,84±1,84 | 615,26±2,31 | 727,90±2,26 |
| ½ Ukrainian red-rye dairy x ½ Monbeliarde | 977,08±2,26*** | 642,74±2,09*** | 634,08±2,12*** | 752,19±3,32*** |

Note. ***P<0,001 compared to Ukrainian black- and red-rye dairy breed.

The highest relative growth rate of live weight in all groups of experimental animals was observed in the period from birth to 6 months, 141.43–142.53 % (table 4). With the age of calves, this figure decreased, and the lowest was in the period from 12 to 18 months of age 29.17–30.01 %.

4. Relative growth rate of heifers, %

| Breed | Age periods, months | | | |
|---|---------------------|---------------|------------|----------------|
| | 0–6 | 6–12 | 12–18 | 0–18 |
| Ukrainian black-rye dairy | 141,77±0,26 | 43,30±0,19 | 29,17±0,18 | 169,76±0,14 |
| ½ Ukrainian black-and-white dairy x ½ Brown Swiss | 142,44±0,20* | 48,07±0,16*** | 29,38±0,17 | 171,04±0,16*** |
| Ukrainian red-rye dairy | 142,53±0,34 | 43,12±0,20 | 30,01±0,19 | 170,31±0,20 |
| ½ Ukrainian red-rye dairy x ½ Monbeliarde | 141,43±0,28* | 42,87±0,28 | 29,46±0,26 | 169,52±0,33 |

Note. *P<0,05; ***P<0,001 compared to Ukrainian black- and red-rye dairy breed.

In order to evaluate the growth patterns of heifers, we have studied the indices that characterize the intensity of their growth (table 5). It was established that the heifers of the Ukrainian black-rye dairy breed had higher rates for all indices compared with the Brown Swiss. In particular, in the index of intensity of decline, they dominated the margins by 0.88 %, indicating a slightly higher intensity of animal formation in early ontogeny. Otherwise, the indicators of the growth of the heifers of the regions of the Ukrainian red-rye dairy breed and the Monbeliarde dominated the red-rye analogues by all indicators, in addition to the growth of energy decline index (<2.60 %).

5. Indices that characterize the growth of heifers

| Breed | Intensity of organism formation | Growth index | Uniformity growth index | Growth tension | Decrease of relative growth rate, % | Growth of energy decline index, % |
|---|---------------------------------|--------------|-------------------------|----------------|-------------------------------------|-----------------------------------|
| Ukrainian black-rye dairy | 0,980 | 0,090 | 0,378 | 1,485 | 99,21±1,64 | 112,58±0,86 |
| ½ Ukrainian black-and-white dairy x ½ Brown Swiss | 0,933 | 0,079 | 0,376 | 1,401 | 92,34±1,56** | 111,70±0,42 |
| Ukrainian red-rye dairy | 0,991 | 0,092 | 0,388 | 1,538 | 101,12±1,32 | 112,72±0,73 |
| ½ Ukrainian red-rye dairy x ½ Monbeliarde | 0,995 | 0,099 | 0,401 | 1,594 | 102,37±1,58 | 111,84±0,93 |

Note. **P<0,01 compared to Ukrainian black- and red-rye dairy breed.

Conclusion. It has been established that the use of cross-breeding as an element of improvement of commercial herds has had a different effect on the growth and development of first-generation heifers in comparison with pure-parent analogues. The heifers of the Ukrainian black-rye dairy breed were characterized by higher live weight values compared to the Brown Swiss, while the heifers derived from the crossing of the Monbeliarde with the Ukrainian red-billed dairy were, on the contrary, marked by a larger live weight compared with the red-rye ones.

The highest average daily increments and, accordingly, the relative growth rate from birth to 6, 12 and 18 months of age were found in the heifers of the Ukrainian red-rye dairy with the Monbeliarde breed.

BIBLIOGRAPHY

1. Гавриленко М. С. Ріст телиць голштинської породи залежно від їхньої лінійної належності / М. С. Гавриленко, Н. В. Куновська // Розведення і генетика тварин : між від. темат. наук. зб. – 2005. – Вип. 38. – С. 136–138.

2. Коваленко В. П. Молочна продуктивність корів у залежності від інтенсивності їх росту / В. П. Коваленко // Науково-технічний бюлетень. – Х., 2001. – №30. – С. 71–73.
3. Кросбридинг як елемент високопродуктивного молочного скотарства / [Рубан С. Ю., Федота О. М., Мітіогло В. О. та ін.] // Біологія тварин, 2016. – Т. 18, №2. – С. 94–104.
4. Сучасні технології виробництва молока (особливості експлуатації, технологічні рішення, ескізні проекти) / [Рубан С. Ю., Борщ О. В., Борщ О. О. та ін.]. – Х. : ФОП О. В. Бровін, 2017. – 172 с.
5. Світовий досвід та перспективи використання геномної селекції в молочному скотарстві / [Рубан С. Ю., Даншин В. О., Федота О. М. та ін.] // Біологія тварин, 2016. – Т. 18. – №1. – С. 117–125.
6. Свечин Ю. К. Прогнозирование молочной продуктивности крупного рогатого скота / Ю. К. Свечин, Л. И. Дунаев // Зоотехния. – 1989. – №1. – С. 49–53.
7. Свечин Ю. К. Прогнозирование продуктивности в раннем возрасте / К. Б. Свечин // Вестник с.-х. науки. – 1985. – №4. – С. 103–108.
8. Федорович Є. Західний внутрішньопородний тип української чорно-рябої молочної породи / Є. Федорович // Тваринництво України. – 2009. – №4. – С. 22–23.
9. Федорович Є. І. Західний внутрішньопородний тип української чорно-рябої молочної породи: Господарсько-біологічні та селекційно-генетичні особливості / Є. І. Федорович, Й. З. Сірацький. – К. : Науковий світ, 2004. – 385 с.
10. Milk, Fat, Protein, Somatic Cell Score, and Days Open Among Holstein, Brown Swiss, and Their Crosses / [Dechow C. D., Rogers G. W., Cooper J. B. et al.] // Journal of Dairy Science. – 2007. – Vol. 90. – PP. 3542–3549.
11. Dezetter C. Inbreeding and Crossbreeding parameters for production and fertility traits in Holstein, Montbeliarde and Normande cows / [Dezetter C., Leclerc H., Mattalia S. et al.] // Journal of Dairy Science. – 2015. – Vol. 98. – PP. 4904–4913.
12. Ferris C.P. An examination of the potential of crossbreeding to improve the profitability of dairying in Northern Ireland. Final Report for AgriSearch. – 2012. – P. 24.
13. Ferris C. P. Crossbreeding in Dairy Cattle: Pros and Cons / C. P. Ferri, B. J. Heins, F. Buckley // WCDS Advances in Dairy Technology. – 2014. – Vol. 26. – PP. 223–243.
14. Heins B. Y. Production of pure Holsteins versus crossbreds of Holstein with Normande, Montbeliarde, and Scandinavi on Red / B. Y. Heins, L. B. Hansen, A. Y. Seykora // Journal of Dairy Science. – 2006. – Vol. 89. – PP. 2799–2804.
15. Heins B. J. Short communication: Fertility, somatic cell score, and production of Normande × Holstein, Montbéliarde × Holstein, and Scandinavian Red × Holstein crossbreds versus pure Holsteins during their first 5 lactations / B. J. Heins, L. B. Hansen // Journal of Dairy Science. – 2012. – Vol. – 95. – PP. 918–924.
16. Heins B. J. Survival, lifetime production, and profitability of crossbreds of Holstein with Normande, Montbéliarde, and Scandinavian Red compared to pure Holstein cows / B. J. Heins, L. B. Hansen, A. De Vries // Journal of Dairy Science. – 2012. – Vol. – 95. – PP. 1011–1021.
17. Petersen W. E. Crossbreeding of Dairy Cattle: The Science and the Impact Presented by the Department of Animal Science University of Minnesota, St. Paul April 2, 2007. – P. 21.
18. Weigel K. A. Crossbreeding: a dirty word or an opportunity? Retrieved October 5, 2010, from American Jersey Cattle Association [Електронний ресурс]. – Режим доступу : www.usjersey.com/Reference/WeigelCrossbreeding%2007WDMC.pdf.