

Efficiency of application of analyzing crossing in populations of dairy cattle

A. Boiko,
candidate of agricultural sciences

O. Honchar,
candidate of agricultural sciences

Yu. Sotnichenko,
candidate of agricultural sciences

V. Machulnyi

Cherkasy experimental station of bioresources of the national academy of sciences

The purpose. To justify application of analyzing crossing in populations of domestic dairy breeds. **Methods.** Analysis of scientific probes of foreign authors concerning application of analyzing crossing, assessment of attributes of breeding capacity of cows at crossing. **Results.** Necessity of use of analyzing crossing is justified. It is determined that at use of sperm production of breed Montbéliarde the amount of sperm doses for fruitful fertilization decreases, the amount of cows fertilized after the first fertilization increases, the share of heavy calving reduces for 8,2%. Frequency of postnatal complications at cows depended on history of calving. **Conclusions.** Positive results of analyzing crossing can be gained only at successful, weight selection of breeds, application of up to date procedures of assessment of basic attributes of selection. Crossing should be considered as short-term method followed by pure breeding.

Key words: *analyzing crossing, Montbéliarde, heterosis, milk yield, milk butter, protein, service-period, breeding capacity.*

The process of consolidation of domestic dairy breeds, aimed at preserving high productivity of animals and their resistance, is still dependent on the use of foreign breeding breeders. The main importing countries are the United States, Canada, Germany, France, Sweden, Austria [2]. Among the most common breeds, the semen production of which is brought to Ukraine by the breeders, Holstein, Jersey, Simmental, Monbeljard, Shvitskaya, Red Swedish, Nortskaya [1]. Certain health problems, productive longevity, and the quality of products produced by this product put holstein into the part of those commercial breeds in which these features need to be improved selectively [3]. The most effective selection method remains the crossing [4]. Therefore, the development and implementation of optimal schemes test cross to improve the performance of reproductive ability, duration of economic use and quality characteristics of milk production is relevant for the development of dairy cattle breeding in Ukraine.

Analysis of recent research and publications. Since 2000 the Laboratory of improving animal (Animal Improvement Program Laboratory), whose strategic development is funded by the US Department of Agriculture, evaluated various combinations of pedigree dairy breeds of the United States [5, 6]. The general effect of heterosis by crossing Holstein cows with bulls Ayrshire, Shvitskaya, Jersey and Dairy Shortgork breeds was 3.4%, beloved fat - 4.4%, protein - 4,1%, while the effect of recombination genes ranged from 2.2 to 1.9% [7].

Research results conducted in the United States at the University of Minnesota, Florida Gainesville [8], Denmark (SEGES, 2014) [9], WAIDOERHOEVE Research Center The Netherlands (2003-2010) [10] indicate a high fertility rate hybrids (+ 13.9% fertility after the first insemination, reduce the period of fertilization at 26-31 day, 4.8% fewer complications during childbirth), excellent quality of the milk (total protein yield (kg) + 20.5% total yield of fat (kg) + 22.2%), durability and resistance (preservation of cows after 2 genera within 14 months + 25%, after 3 - + 24%, after 4- + 26%; the average length of use in the herd increases by 30.9% or 1122 days).

Goal. To prove the use of test cross in populations of native dairy breeds.

Materials and methods. Analysis of the results of scientific research by foreign authors on issues the application of analyzing crosses in the Holstein breed, evaluation of the signs of milk productivity and reproductive capacity of cows Ukrainian black-and-white and red-bream dairy breeds for 2016-2017 years (Total estimated 800 heads).

Research results. If on the basis of absolute milkiness Holstein takes the first place in the world, then by signs related to the quality of milk hybrids came out in the first place with Swedish and Jersey breed (Table 1). These areas were widely caught up in the service of the introduction of scientific developments (Extension) into the practice of US production. A large variation is established productive features when applying analyzing cross-linking. Hybrids when crossing Holstein cows with bugs Montb liard, Swedish red and Norman breeds lagged behind in milk yield 1535 kg; 1790 kg and 2102 kg. On the way out milk fat and protein from the combination of Holstein x Montb liard no difference found but on the way out squirrel hybrids inferior to pure-breed analogues of 13 kg. At first sight this casts doubt further use precisely such schemes of crossing.

1. Performance of the firstborn various genetic combinations for the first 305 days of lactation (WAIDOERHOEVE, NETHERLANDS (2003-2010))

Breed, The Local Group	Cows, goal	milk quantity kg	Output of milk (kg)	
			fat	protein
Holstein	291	10967	358	337
two breeds				
Holstein x Norman breed	37	8865	346	288
Holstein x Montb liard	366	9432	358	324
Holstein x Swedish red	162	9177	338	305
three breeds				
Holstein x Shvitska breed x Montb liard	44	9297	418	332
Holstein x Montb liard x Swedish red	43	9461	407	338
Holstein x Jersey x Montb liard	86	8809	371	320

However, modern herds in Ukraine, reaching a productivity level of 6-7 thousand kg of cow milk per year, qualitatively are from 3.0 to 3.75% fat content in milk. And with performance more than 9-10 thousand qualitative composition catastrophically decreases. The average fat content of the herd reaches 2.90%, which is substantially lower than the requirements for dairy raw material of basic fat. Quite often, conditions for the maintenance of animals with a potential for over 8000 kg of milk do not meet their physiological needs. Lowering inherited qualitative composition of milk we get only partial realization of genetic potential at the level of 65-80%, which is 5500-6500 kg of milk with fat content and protein within the range of 3.0-3.1%. It is in these conditions that analytical cross-breeding is appropriate.

In countries of the world, where Holstein cattle are used, breeders felt the consequences unidirectional selection on milk productivity: high level of inbreeding, lowering reproductive capacity and Animal Health, an increase in the number of heavy births and dead calves, genetic defects, etc. Since 1998, California launched a program krosbrydynhu Procross system. Today many countries of the world joined this program and use analyzing cross-references. According to many authors use three breeds in crossing for maximum heterosis effect, whereupon system of selection of pedigrees should be orientated again on the main breed, in this case - Holstein. According to the data Vance E., Ferris C., Elliott C. (2011) [9] the main effect when crossing observed by signs reproduction (Table 2).

2. Indicators of reproductive capacity of cows (Denmark (SEGES, 2014))

Features	Breed, The Local Group			
	H	H x J	H x M	H x Sr
Number of genera	676	262	370	264
Severity of the genera, %	17,7	11,6	7,2	3,7
Dead calves, %	14,0	9,9	6,2	5,1
Fertility in the first insemination, %	43	52	61	64
Period for fertilization, days	135	107	98	93
Productive use, lactation	2,6	4,1	5,6	5,1

Remark: H – Holstein, J – Jersey, M – Montb liard, Sr - Swedish red

Hybrid cows all groups exceeded the indicators cows of Holstein breed by signs reproduction ability during five lactations of their use. Duration the period before fertilization after the first calving decreased by Holstein-Swedish hybrids for 42 days, Holstein- Montb liard for 38 days, Holstein-Jersey for 28 days. All hybrids had a higher duration of economic use by 1.5-3.0 lactation, which provided an increase in life-time profits. Fertility after the first insemination was higher in hybrid groups by 9-21%. From these cows were received lower percentage the birth of dead calves (from 5.1 to 9.9%) and difficult childbirth (from 3.7 to 11.6%).

From 2016 authors of domestic breeds in Ukraine decision made about search optimal schemes analyzing the crossing. At the first stage recommended to use bulls Montb liard breed. For analysis indicators of reproductive capacity, in 9 herds where used sperm bulls breeds Montb liard and Holstein was formed analogue groups of cows Ukrainian red and white dairy breeds (Table 3).

3. Indicators of reproductive capacity of cows (*Cherkasy Experimental Station of Bioresources, NAAS, 2017*)

Features	Parents' couples, ♀♂	
	UCheR H	UCheR M
Number of animals, heads	400	400
Pregnancy after 1 insemination, %	46,3	57,1
Number of sperm dosages per fruitful insemination	3,9±0,21	3,3±0,16
Period before fertilization after calving, days	132±8,0	111±7,6
Period between childbirth, days	417±3,6	396±4,2
Complication:		
Difficult childbirth, %	18,4	10,2
The number of calves born dead, %	6,8	3,1
Diseases of the reproductive system % of cases	20,0	10,9

Примітка: UCheR – Ukrainian red and white dairy breed, M – Montb liard, H - Holstein

Installed that when using semen the breed is a Montb liard was used less quantity sperm dosage for fruitful insemination (0. dose of sperm) increased the share of cows fertilized after the first insemination by 10.8%, which in turn affects for duration service period between births by groups. When fertilizing cows bull semen the breed is a Montb liard childbirth passed independently in 74,6% of all analyzed cases, 15.2% - did not need much help and only 10.2% - had a difficult birth. In the group of cows where used for playback Holstein bulls part difficult births was 8.2% higher, which is, in our opinion, due to the heredity of the Holstein breed, which is genetically large-fruited. Installed the frequency disease reproductive system of cows were registered more often in the group with higher frequency difficult births (20.0% of heads).

Conclusions.

Positive results from analyzing cross-breeding can be received only successful, weighed selection of breeds, adherence to the appropriate feeding conditions and animal husbandry technology, application of modern methods of evaluation of the characteristics, which is selection, aimed at using the best bulls. Comprehensive rotational crossing for using 3-4 selectable for most of the signs of unrelated breeds should be considered as a short-term method, after which the system of selection of bulls it is necessary to orientate again to the main breed.

Bibliography

1. Bashchenko M.I. Stan i perspektyvy poridnoho udoskonalennia molochnoho skotarstva i vidnovlennia systemy selektsii buhaiv - *Status and prospects of breed improvement of dairy cattle breeding and restoration of the system of cattle breeding* / M. I. Bashchenko, Yu. P. Polupan, S. Yu. Ruban, I. V. Bazashyna // *Rozvedennia i henetyka tvaryn - Animal breeding and genetics*. – 2012. – Vyp. 46. – S. 79–83.

2. Bashchenko M.I. Dosvid i perspektyvy vykorystannia krosbrydynhu v molochnomu skotarstvi - *Experience and prospects of crossbred use in dairy cattle breeding* / M.I.Bashchenko, O.I.Kostenko, S.Iu. Ruban // *Visnyk ahrarnoi nauky - Bulletin of Agrarian Science*. – 2016. – № 5.– S.28-33.

3. Danshin V.A. Otsenka geneticheskoy tsennosti zhyvotnyih - *Assessment of the genetic value of animals*. - K.: Agrarna nauka - *Agrarian science*, 2008. – 180 s.
4. Kruhliak A.P. Ukrainska chervono-riaba molochna poroda – rezultat realizatsii novoi teorii u skotarstvi - *Ukrainian red and white breed is the result of a new theory of cattle breeding*/A.P. Kruhliak, O.D. Biriukova, H.S. Kovalenko, T.O. Kruhliak//*Rozvedennia i henetyka tvaryn - Animal breeding and genetics*. K. 2015. – Vyp. 50. – S. 39- 47.
5. Ruban S.Yu. Otsenka effektivnosti mezhporodnogo skreschivaniya v molochnom skotovodstve - *Assessment of the effectiveness of interbreeding in dairy cattle breeding* /S.Yu.Ruban, V.A.Danshin/ *Problemi zoolnzheneriyi ta veterinarnoYi meditsini: zb. nauk. prats.Sliskogospodarskl nauki.- Problems of zoinengineering and veterinary medicine: Sb. sciences works. Agricultural sciences –H.*, 2002. –Vip. 11 (35)., ch.1.– S.130-136.
6. Ruban Yu.D. Biologiya i evolyutsiya v selektsii zhyvotnyih i tehnologii proizvodstva - *Biology and evolution in animal breeding and production technology* / Yu.D. Ruban. – K.: Agrarna nauka - *Agrarian science*, 2005. – 224 s.
7. Van Raden P.M., Cole J.B. Net merit as a measure of lifetime profit: 2014 revision // *Animal improvement Program, Animal Genomics and improvement laboratory, Agricultural Research Service, USDA, Beltsville. MD.*, 2014.
8. Conrad Ferris, P. Crossbreeding in Dairy Cattle: Pros and Cons / P. Conrad Ferris, J. Bradley Heins, F. Buckley // *WLDS Advances in Dairy Tehnology*. 2014. Vol. 26. – P. 223–243.
9. Vance, E. R. Food intake, milk production and tissue changes of Holstein-Friesian and Jersey H. F. dairy cows within a low concentrate input grazing system and high concentrate input total confinement system / E. Vance, C. Ferris, C. Elliott // *J. Dairy Sci*. 2011. – Vol. 95. – P. 1527–1544.
10. Heins, B. J. Short communication: Jersey Holstein crossbreds compared with pure Holsteins for body weight, body condition Score, fertility, and survival during the first three lactations / B. Heins, L. Hansen, A. Hasel // *J. Dairy Sci*. 2012. – Vol. 95. – P. 4130–4135.