

DEVELOPMENT OF GENETIC RESOURCES OF DAIRY CATTLE BREEDING IN UKRAINE

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The purpose of the article is to carry out an evaluation of genetic resources of breeding dairy cattle Ukraine. The research was conducted on the observation materials of the State Statistics Service of Ukraine, the International Committee for Animal Recording, the State Register of subjects of breeding business in livestock breeding by using statistical methods. The breed of cows is an important factor in the economic efficiency of dairy cattle-breeding. Due to the long intensive selection work on cattle breeds, the milk productivity of cows in developed livestock countries has reached levels of 8.0–10.0 thousand kg and more for 305 days of lactation. The number of cows in breeding farms in Ukraine for 2006–2019 has decreased by 38 thousand head or by 22%. In the breeding structure of pedigree dairy cattle, animals of Ukrainian Black and White Dairy (49.9%), Holstein breeds (25.2%) and Ukrainian Red and White Dairy (14.4%) prevail.

Keywords: dairy cattle breeding, efficiency, breed, productivity, calves output, economies of scale

РОЗВИТОК ГЕНЕТИЧНИХ РЕСУРСІВ МОЛОЧНОГО СКОТАРСТВА УКРАЇНИ

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Мета статті – провести оцінку генетичних ресурсів молочного скотарства України. Дослідження проведено за матеріалах спостережень Державної служби статистики України, Міжнародного комітету з питань обліку тварин, Державного реєстру суб'єктів племінної справи у тваринництві за допомогою статистичних методів. Порода корів – важливий фактор економічної ефективності молочного скотарства. Завдяки тривалій інтенсивній селекційній роботі з породами великої рогатої худоби, молочна продуктивність корів у країнах з розвинутою галуззю тваринництва досягла рівня 8,0–10,0 тис. кг і більше за 305 днів лактації. Поголів'я корів у племінних господарствах України за 2006–2019 роки зменшилось на 38 тис. голів або на 22%. У порідній структурі молочного скотарства найчисленнішими є українська чорно-ряба молочна порода – 68,8 тис. племінних корів (49,9%), голитинська (25,2%) та українська червоно-ряба молочна (14,4%) породи.

Ключові слова: молочне скотарство, ефективність, порода, продуктивність, вихід телят, ефект масштабу

РАЗВИТИЕ ГЕНЕТИЧЕСКИХ РЕСУРСОВ МОЛОЧНОГО СКОТОВОДСТВА УКРАИНЫ

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Цель статьи – провести оценку генетических ресурсов молочного скота Украины. Исследование проводилось по материалам наблюдений Государственной службы статистики Украины, Международного комитета по учету животных, Государственного реестра субъектов племенного дела в животноводстве с использованием статистических методов. Порода коров – важный фактор экономической эффективности молочного скотоводства. Благодаря длительной интенсивной селекционной работе с породами крупного рогатого скота, молочная продуктивность коров в странах с развитым животноводством достигла уровня 8,0–10,0 тыс. кг и более за 305 дней лактации. Поголовье коров в племенных хозяйствах Украины за 2006–2019 годы уменьшилось на 38 тыс. голов или на 22%. В структуре племенного молочного скота преобладают коровы украинской черно-пестрой (49,9%), голштинской (25,2%) и украинской красно-пестрой (14,4%) пород.

Ключевые слова: молочное скотоводство, эффективность, порода, продуктивность, выход телят, эффект масштаба

Introduction. Dairy cattle breeding is one of the most important and promising sectors of world livestock breeding. According to FAO (the Food and Agriculture Organization of the United Nations) statistics, the share of cow's milk production in the global milk production structure is 82.7% [1]. There are about 133 million farms in the world, where there are more than 264 million dairy cows producing more than 650 million tons of milk each year [2, 3]. According to the International Dairy Federation (IDF), the largest cow's milk is produced in the Asian region – 29% of the world's total, 28 European countries – 24, countries of North and Central America – 18, South America – 10%. The share of dairy production in other countries of Europe, Africa and Oceania is 9; 5; 5% respectively [3].

According to Dairy Campus scientists' researches at the University of Wageningen (the Netherlands), the demand for milk and dairy products in the world by 2050 will increase 1.5 times – to 1077 billion kg. Additional volumes will be produced and consumed, mainly in developing countries. So, there were countries on the market, milk production growth rates in which over the past 15 years exceeded world figures. Among them – India and Pakistan (production leaders in the informal segment), Russia (plans to satisfy their own needs for milk in 5–10 years), China (invests not only in its own production, but also in the dairy business of Russia, Australia, New Zealand), Belarus, Uzbekistan (an increase in the production of raw milk by 2.5 times in 15 years), Tajikistan, Kyrgyzstan, Armenia, Azerbaijan, Turkey, Iran [4, p. 2].

At the present stage, the development of dairy farming needs to focus on increasing the livestock population with high productive indicators in the large-scale sector. In the period from 2000 to 2020, the number of cows in Ukraine decreased by 2.8 times (from 4958.3 thousand heads on 01.01.2001 to 1788.5 thousand heads on 01.01.2020), and in agricultural enterprises – by 4.2 times (from 1851.0 to 438.6 thousand heads respectively) [5]. An important factor in the growth of the large-scale sector should be the revival of the national selection system. Therefore, the issue of scientific substantiation of the organizational principles of effective management of breeding dairy cattle breeding is now of particular urgency.

Materials and methods of research. The purpose of the article is to carry out an evaluation of genetic resources of breeding dairy cattle Ukraine. The research was conducted on the observation materials of the State Statistics Service of Ukraine, the International Committee for Animal Recording, the State Register of subjects of breeding business in livestock breeding by using statistical methods.

Research results. Cattle breeds are differ according to economic indicators of useful traits of animals, including the level of productivity, which significantly influences the economic efficiency of production. According to ICAR (The International Committee for Animal Recording), cows of the Holstein breed remain the leaders, whose productivity for the 305 days of lactation is at the level of 9–11 thousand kg of milk (Table 1). Such achievements are the result of a long intensive breeding work aimed at increasing milk production.

Among other breeds, which cow' productivity approaches the animals Holstein breed, Ayrshire (up to 9.0 thousand kg), Braunvieh, Montbeliarde, Fleckvieh, Norwegian Red, Swedish Red, Jersey (7.0–8.0 thousand kg) are next (Table 2). A number of breeds are distinguished by qualitative features of dairy productivity. For example, the fat content in milk of cows of the Jersey breed of Canadian breeding is 5.1% [6]. The milk productivity of these breeds is lower than Holstein dairy cows. But they have significant benefits in functional traits such as high reproductive capacity, extended duration of economic use, high payment of feed by the resulting products, which increases their competitiveness to the level of animals of the Holstein breed.

1. Main economic traits of recorded Holstein Black and White cows in some countries of the world in 2019

Country	Milk per cow in 305 days (kg)	Percent fat content (%)	Percent protein content (%)	Calving interval (days)
USA	11629	3.82	3.31	...
Canada	10909	3.98	3.27	...
Finland	10590	4.22	3.52	409
South Korea	10352	3.92	3.21	460
Czech Rep.	10253	3.86	3.39	400
Estonia	10193	3.79	3.35	409
Slovak Republic *	9762	3.78	3.26	412
Belgium	9681	4.11	3.46	406
Germany	9393	4.05	3.44	409
Norway	9381	4.2	3.42	397
Denmark	9294	4.09	3.51	...
France	9048	3.94	3.31	421
Austria	8972	4.06	3.32	...
Ukraine	8965	3.91	3.40	...
Switzerland	8960	3.99	3.25	412
New Zealand	3846	4.45	3.76	...

* 2018 y.... No information. **Source:** The International Committee for Animal Recording [6].

2. Main economic traits of recorded dairy cows in some countries of the world in 2019

Breed	Country	Milk per cow in 305 days (kg)	Percent fat content (%)	Percent protein content (%)	Calving interval (days)
Braunvieh	Canada	8982	4.22	3.55	...
	Ukraine	8877	3.83	3.60	407
	Germany	7565	4.25	3.62	416
	Austria	7527	4.15	3.51	...
	Switzerland	7235	4.09	3.30	392
Ayrshire	Finland	9529	4.49	3.57	406
	Canada	8159	4.15	3.41	...
	USA	6974	4.00	3.37	...
	Ukraine	6369	3.95	3.10	428
Fleckvieh	USA	8701	4.17	3.63	...
	Austria	7734	4.15	3.43	...
	Germany	7725	4.19	3.54	393
	France	6654	3.99	3.52	398
	Ukraine	6211	4.00	3.22	...
	Switzerland	6080	3.97	3.35	383
Normande	Switzerland	7025	4.08	3.42	393
	France	6669	4.19	3.61	407
Montbeliarde	Czech Rep.	8361	4.05	3.55	384
	Switzerland	7607	3.78	3.37	395
	France	7286	3.85	3.45	401
Norwegian Red	Norway	7705	4.32	3.47	379
Swedish Red	Sweden	7648	4.36	3.62	392
Pinzgauer	Austria	5069	3.92	3.34	...
	Canada	7106	5.13	3.87	...

... No information. **Source:** The International Committee for Animal Recording [6].

In Ukraine, the highest milk productivity is Holstein (8965 kg), Fleckvieh (8877 kg), Ukrainian Black and White Dairy (7486 kg) and Ukrainian Red and White Dairy (6997 kg). Currently, in 344 breeding herds, 137.8 thousand cows are kept, which is one third less than 10 years ago (Table 3). The most numerous is the Ukrainian Black and White Dairy – 68.829 purebred cows, or 49.9% in the structure of dairy cattle breeding herds. The share of Holstein – 25.2%, Ukrainian Red and White Dairy is 14.4%.

3. The structure of the dairy cattle breeding stock in Ukraine, at the beginning of the year

Breed	Number of recorded herds				Number of recorded cows			
	2007	2012	2017	2020	2007	2012	2017	2020
Ukrainian Black and White Dairy	358	206	177	169	91546	75535	68181	68829
Ukrainian Red and White Dairy	161	98	68	59	37905	31920	25340	19825
Ukrainian Red Dairy	42	29	17	16	13348	9309	6489	5127
Holstein	35	34	44	64	10504	14211	18467	34752
Fleckvieh	56	28	18	15	9372	5181	4916	4322
Red Steppe	40	15	6	6	8832	4135	1642	1436
Lebedynska	8	6	3	3	1433	1122	713	648
Ukrainian Brown Dairy	7	4	2	2	1008	479	170	170
Brown Carpathian	10	1	–	–	863	146	–	–
Polish Red	5	3	1	1	662	509	136	116
Angler	3	3	3	3	352	333	251	266
Ayrshire	2	2	2	2	322	513	523	533
Ukrainian Whiteheaded	1	1	1	1	160	320	300	300
Braunvieh	1	1	2	3	128	100	1101	1457
Pinzgauer	2	–	–	–	60	–	–	–
Total	731	431	344	344	176495	143813	128229	137781

– There were no phenomena. **Source:** The State Register of pedigree animal husbandry [7].

It should be noted the extremely insufficient number of cows of the active part of the livestock (breeding stock-rearing farms that are certified as subjects of the tribal affairs and conduct breeding records) – 29.5% of the number of cows kept in agricultural enterprises, and 7.7% – at farms all categories. For example, in Israel (the world leader in the cows' milk productivity in level about 12 thousand kg per cow) it is more than 90%. In other countries with a developed dairy industry, this figure is at 90% – in Denmark [8], 86% in Sweden [9], and 70% in Canada [10]. The low proportion of the recorded dairy livestock in Ukraine greatly complicates the process of improving high-yielding herds.

Over the past ten years, the number of breeding stock-rearing farms in Ukraine has doubled. Among them there was a tendency for livestock consolidation. Average number of cows in herds the breeding stock-rearing farms was: in 2007 – 241 heads, in 2012 – 334, in 2017 – 373, in 2019 – 401 (Table 2). In 2007–2019, as a result of ongoing concentrations of livestock, the average size of a purebred dairy herd increased almost one and a half times, which, due to the scale effect, made it possible for enterprises to reduce production costs per unit.

The average milk yield of purebred cows in industrial enterprises increased from 4606 kg in 2007 to 7653 kg in 2019, or almost one and a half times (Table 4). Due to the effect of the factor of natural biological antagonism on the milk productivity and reproductive capacity of cows, the raising of productivity with an increase in the heredity of the Holstein breed has led to a decrease in the calving output of 100 cows, and a decrease in the length of the commercial use of cows. This trend is also characteristic of all newly created dairy breeds. In particular, from Ukrainian Black and White Dairy cows the calving output per 100 cows decreased from 82.8 heads in 2006 to 77.4 in 2019; Ukrainian Red and White Dairy respectively from 82.2 to 69.5 calves; Ukrainian Red Dairy, where the proportion of the heredity of the Holstein breed is slightly lower than the first two, the calving rate dropped at lower pace.

According to the results of dairy cattle recording, among the domestic breeds the highest milk productivity is in the Ukrainian Black and White Dairy cows – 7364 kg with a fat content of 3.74%, protein 3.22%; Ukrainian Red and White Dairy – respectively 6989; 3.78; 3.27; Ukrainian Red Dairy

– 6549; 3.90; 3.26 (Table 5). Domestic breeds on genetic potential are at the level of the best European analogues, and according to indicators of reproduction and health they prevail them.

4. Economically important traits recorded purebred cows in Ukraine

Breed	Milk per cow in 305 days (kg)				Exit calves per 100 cows (heads)			
	2006	2011	2016	2019	2006	2011	2016	2019
Ukrainian Black and White Dairy	4708	5413	6732	7486	82.78	80.35	76.81	77.44
Ukrainian Red and White Dairy	4654	5601	6627	6997	82.22	80.90	79.22	69.55
Ukrainian Red Dairy	4277	4883	5834	6284	82.86	79.42	80.61	80.05
Holstein	6006	7223	8071	8965	68.15	70.18	73.90	76.92
Fleckvieh	3850	5030	6095	6211	87.06	82.36	91.81	79.40
Red Steppe	3526	3607	4052	3910	83.58	77.95	78.64	71.92
Lebedynska	4018	3783	5236	4671	76.36	86.53	93.03	95.69
Ukrainian Brown Dairy	4347	5579	3892	4743	44.8	86.22	73.68	81.18
Brown Carpathian	2591	2991	–	–	70.18	40.32	–	–
Polish Red	3099	3398	1842	–	71.16	67.38	89.09	30.94
Angler	4112	3965	4461	4345	85.07	75.08	82.43	75.81
Ayrshire	4353	5922	6269	6369	84.40	69.92	67.30	63.07
Ukrainian Whiteheaded	3344	3838	4988	4850	88.34	88.12	86.00	91.67
Braunvieh	3789	2356	8380	8877	87.50	88.00	57.76	85.35
Pinzgauer	2379	–	–	–	80.36	–	–	–
Average	4606	5506	6785	7653	81.93	79.55	78.62	77.93

– There were no phenomena. **Source:** The State Register of pedigree animal husbandry [7].

5. The characteristic of dairy herds Ukraine in 2011–2019, according to the results of the dairy cattle recording

Year	Number of herds	Number of bonitized cows	Productivity (for 305 days last completed lactation)				
			milk per cow (kg)	percent content (kg)		percent content (%)	
				fat	protein	fat	protein
Ukrainian Black and White Dairy							
2019	169	53623	7364	275.14	237.51	3.74	3.22
2018	171	52579	7236	268.07	238.97	3.71	3.30
2017	177	52173	6912	257.11	226.21	3.72	3.27
2016	180	52606	6613	245.41	216.47	3.71	3.27
2015	183	55640	6376	235.34	208.71	3.69	3.27
2014	194	54722	6223	231.21	203.26	3.72	3.27
2013	184	49814	6008	223.18	197.01	3.71	3.28
2012	206	54122	5805	214.85	188.56	3.70	3.25
2011	221	60292	5493	204.71	178.32	3.73	3.25
2010	255	63516	5259	195.16	169.79	3.71	3.23
Ukrainian Red and White Dairy							
2019	59	14901	6989	264.49	228.75	3.78	3.27
2018	70	17589	6791	257.24	223.41	3.79	3.29
2017	68	18465	6640	250.70	218.52	3.78	3.29
2016	75	18814	6357	238.78	206.39	3.76	3.25
2015	77	20285	6368	242.22	207.83	3.80	3.26
2014	84	21494	6236	234.90	202.53	3.77	3.25
2013	89	21195	6091	232.19	200.26	3.81	3.29
2012	98	23964	6093	231.07	197.78	3.79	3.25
2011	107	25751	5588	210.55	182.17	3.77	3.26
2010	120	27173	5430	203.05	177.51	3.74	3.27
Ukrainian Red and White Dairy							
2019	16	3963	6549	255.05	213.90	3.90	3.26
2018	17	4194	6436	250.08	209.15	3.89	3.25
2017	17	4517	6295	243.50	201.32	3.87	3.20
2016	19	5117	5963	230.99	196.17	3.87	3.29
2015	19	4924	5778	225.27	188.65	3.90	3.26
2014	19	4688	5981	232.36	193.88	3.88	3.24
2013	22	4902	5837	225.15	189.21	3.86	3.24
2012	29	6641	5381	207.17	172.50	3.85	3.21
2011	29	7199	5073	194.04	161.49	3.82	3.18
2010	35	8362	4811	186.09	157.02	3.87	3.26

Source: author calculations on the basis of data from the The State Register of pedigree animal husbandry [7].

Conclusions. Consequently, the breed of cows is an important factor in the economic efficiency of dairy cattle-breeding. Due to the long intensive selection work on cattle breeds, the milk productivity of cows in developed livestock countries has reached levels of 8.0–10.0 thousand kg and more for 305 days of lactation.

The number of cows in breeding farms in Ukraine for 2006–2019 has decreased by 38 thousand head, or by 22%. The average milk yield of purebred cows in industrial enterprises increased from 4606 kg in 2007 to 7653 kg in 2019, or almost one and a half times. But the extremely insufficient number of cows of the active part of the livestock greatly complicates the process of improving high-yielding herds.

In the breeding structure of pedigree dairy cattle, animals of Ukrainian Black and White Dairy (49.9%), Holstein breeds (25.2%) and Ukrainian Red and White Dairy (14.4%) prevail.

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