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### RESEARCH ARTICLE

#### INFLUENCE OF GENETIC POTENTIAL ON THE LEVEL OF DAIRY PRODUCTIVITY OF COWS

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#### Abstract

Research on the influence of the genetic potential of cows on the level of their milk productivity was carried out on the basis of the Prigorodny Agricultural production cooperative - the Republic of Mari El of the Russian Federation. The object of research was Holstein cows of black-and-white breed in the number of 352 cows. The level of dairy productivity of cows in the Prigorodny Agricultural production cooperative is at a high level. The milk yield of cows in the average herd made up 5805 kg Mass fraction of fat of 4.01%. The mass fraction of protein is 3.03%. When studying the influence of the genetic potential of cows on the level of dairy productivity in the farm, it was found that with an increase in the genetic potential, the milk yield of cows increases. A small positive correlation was found between the parent index of cows and milk yields (for 1 lactation, maximum and average) ( $r=0.2$ ). As a result of research, it was found that the realization of the genetic potential in animals of different lines varied: milk yield - from 85% to 110%, fat mass fraction - from 97 to 102%, protein - from 95 to 96%. It was found that animals of the PubstGoverner 882933 line realized their genetic potential.

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#### Introduction:-

Over the past 50 years, milk production from dairy cows has increased significantly worldwide<sup>3</sup>. Our country has a variety of dairy breeds with a genetic potential of 5000-9000 kg of milk. The preservation and improvement of this valuable gene pool is carried out in breeding farms, which include the Prigorodny Agricultural production cooperative of the Russian Federation.

The specificity of dairy cattle breeding determines the features of intensification, due to which the efficiency of the industry depends on the degree of use of the genetic capabilities of animals<sup>6,7,8</sup>. Dairy breeds require scientists to have in-depth knowledge on the formation of milk productivity<sup>2</sup>. According to data received from: T. Johnson, K. Eketone, L. McNaughton, K. Tiplady and C. Couldrey<sup>5</sup> - the genetic potential of animals allows you to increase the productivity of dairy cows more than twice. According to some authors<sup>1,4,9</sup>, the widespread breeding use of highly productive cows contributes to the accumulation of valuable genetic potential in subsequent generations, which increases the chances of obtaining more productive breeding herds.

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## Materials and Methods:-

The research was conducted on the basis of the Prigorodny Agricultural production cooperative of the Republic of Mari El of the Russian Federation. The object of research was Holstein cows of black-and-white breed in the number of 352 cows.

**The aim of the research is to identify the influence of the genetic potential of cows on their level of milk productivity. To achieve this goal it was necessary to solve the following tasks:**

1. Study the dairy productivity of the herd;
2. Determine the potential of animals of different genotypes;
3. Analyze the implementation of the genetic potential of cows.

To determine the potential productivity of animals, the parental index of a cow (PIC) was calculated using the formula:

$$PIC = (2M + MO + MM) / 4,$$

Where, M – average productivity for the mother;

MM-average productivity for the mother of the mother;

MO – average productivity for the father's mother.

Realization of genetic potential (RGP) for cows was calculated using the formula:  $RGP = \frac{F}{O} \times 100\%$

Where, F – actual milk yield of cow;

O-parent index of the cow.

## Results and Discussion:-

Studies have shown that the level of dairy productivity of cows In the agricultural production cooperative Prigorodny is at a high level. The milk yield of cows in the average herd made up 5805 kg Mass fraction of fat of 4.01%. The mass fraction of protein is 3.03%.

As a result of research, it was found that the milk yield of cows increases with the age of animals and reaches a maximum of 6011 kg by the third lactation. After that, there is a decline in productivity to 5334 kg for the period of 9 lactation.

The main method of breeding used in breeding farms is line breeding. When breeding in a herd of selected representatives of highly productive lines, the number of animals with valuable genetic qualities increases and the breed improves. Analyzing the level of milk productivity of cows of different linear affiliation for 1 lactation, it was found: first-born cows of the line R. Sovering 198998 exceeded cows of the line V. B. Ideal 1013415 – by 198 kg; M. Chieftain 95697 – by 89 kg; P. Governor 882933 – by 108 kg; S. T. Rocket 252803 –by 1140 kg ( $P \leq 0.01$ ). Maximum and average milk yields are highest in cows of the P. Governor 882933 line. In terms of milk yield for the highest lactation, cows of this line were fed more than those of the line V. B. Ideal 1013415 - by 675 kg ( $P \leq 0.01$ ); M. Chieftain 95697 - by 537 kg; R. Sovering 198998 – by 521 kg ( $P \leq 0.05$ ); S. T. Rocket 252803-by 984 kg ( $P \leq 0.01$ ). On average, for a number of lactations: 406 kg ( $P \leq 0.001$ ), 57 kg, 133 kg, 752 kg ( $P \leq 0.01$ ). The fat content of milk was higher in cows of the M. Chieftain 95697 line, and averaged 3.95%. The protein content of cows, depending on the linear affiliation, varied in the range of 3.01-3.03%.

The analysis of potential possibilities of animals showed that the number of cows in the farm has a high genetic potential. The parent index for cows in the average herd for the yield of milk amounted to 6738 kg mass fraction of fat of 3.90%. For the mass fraction of protein at 3.16%. Animals of the S. T. Rocket 252803 line has the highest genetic potential. The parent index for milk yield in this group of cows was 7251 kg. According to the mass fraction of fat-4.04%. Studying the genetic potential of cows depending on the genotype of the father, it was found that the daughters of bulls Monument 1105 and Emirate 400134 have the highest genetic potential for milk yield - 7298 kg and 7273 kg. Argon 1108 - for the mass fraction of protein in milk - 3.19%. The descendants of Monument 1105 had the highest parental index for the mass fraction of fat -3.97%.

When studying the influence of the genetic potential of cows on the level of dairy productivity in the farm, it was found that with an increase in the genetic potential, the milk yield of cow's increases. A small positive correlation was found between the parent index for cows and milk yields (for 1 lactation, maximum and average) ( $r=0.2$ ). As a result of the research, it was found that the maximum milk yield of 5889 kg was registered in first-born Chicks with

a parent index of more than 9000 kg. The Animals in this group exceeded their peers with a parent index of up to 5000 kg by 647 kg, 5001-6000 kg by 630 kg, 6001-7000 kg by 501 kg, 7001-8000 kg by 197 kg, 8001-9000 kg by 188 kg (table 1).

**Table 1:-** Effect of genetic potential on cow milk yield.

Parent index for cows by milk yield, kg	n	Milkyield, kg								
		for 1 lactation			thehighestlactation			theaveragelactation		
		M	m	Cv,%	M	m	Cv,%	M	m	Cv,%
upto 5000	25	5242	154,6	14,5	6212	128,2	10,3	5585	88,8	8,0
5001-6000	94	5259	88,7	16,3	6660	77,5	11,3	5765	49,2	8,3
6001-7000	108	5388	89,7	17,3	6600	70,8	11,1	5818	58,5	10,4
7001-8000	73	5692	135,5	20,3	6529	86,6	11,3	5883	81,4	11,8
8001-9000	37	5701	111,4	11,7	6442	145,5	13,7	5792	88,2	9,3
9001 andmore	15	5889	303,2	19,9	6770	180,0	10,3	5969	140,1	9,1

The variability of milk yield in the study groups ranged from 11.7 to 20.3%. At maximum milk yield, the highest indicator is higher by 558 kg ( $P \leq 0.01$ ). When studying the effect of the genetic potential of cows on milk yield at the highest lactation, the best results were shown by cows whose parent index was more than 9000 kg. The milk yield of this group of cows was 6770 kg. Similar results were obtained for the average milk yield for a number of lactations. Cows with a parent index of more than 9000 kg of milk had higher rates of milk yield for a number of lactations.

Variability of milk yield in the groups with the highest lactation in the range-10.3-13.7%. Variability in groups by average milk yield is 8.0-11.8 %. Analysis of the effect of genetic potential on the mass fraction of fat in cow's milk shows that in the first lactation, in the highest and in the average lactation for a number of lactations, the lowest fat content of milk had cows with a parent index of 3.6% or less (table 2). The mass fraction of fat in milk in this group of cows for 1 lactation was 3.89%. The mass fraction of fat in milk for the highest lactation is 3.93%. The mass fraction of fat in milk on average is 3.85%. The most fat-dairy cows with a parent index of more than 3.8%. The fat content of the milk of such cows in 1 lactation was equal to 3.91-3.93%. The fat content of the milk of such cows in the highest lactation is 4.02%. The fat content of the milk of such cows is on average 3.9%.

The variability of the mass fraction of fat in milk, depending on the value of the parent index for cows, fluctuated for 1 lactation - 2.9-5%. In the highest lactation-1.1-2.2%, on average-2.1-4%.

**Table 2:-** Effect of genetic potential on the mass fraction of cow fat.

Parent index for cows by mass fraction of fat, %	n	Massfractionoffat, %								
		for 1 lactation			thehighestlactation			theaveragelactation		
		M	m	Cv,%	M	m	Cv,%	M	m	Cv,%
3,6 orless	4	3,89	0,06	2,9	3,93	0,04	2,1	3,85	0,02	1,1
3,61-3,8	85	3,91	0,02	4,4	4,00	0,01	3,1	3,89	0,01	1,7
3,81-4,00	177	3,93	0,01	4,8	4,02	0,01	4,0	3,90	0,01	2,3
4,01 ormore	86	3,93	0,02	5,0	4,02	0,02	3,9	3,90	0,01	2,2

Analysis of the effect of genetic potential on the mass fraction of protein during the first lactation shows the maximum value for cows with a genetic potential of 3.31% or more.

The mass fraction of protein in these cows in 1 lactation was 3.09%. The mass fraction of protein for the highest lactation is 3.14%. The mass fraction of protein on average for a number of lactations is 3.05%. Animals with a parent index of 3.21-3.3% took the second place in terms of protein content. The mass fraction of protein in the milk of these cows for 1 lactation was 3.03%. The mass fraction of protein in the milk of these cows for the highest lactation is 3.09%. The mass fraction of protein in the milk of these cows is on average 3.04% (table 3).

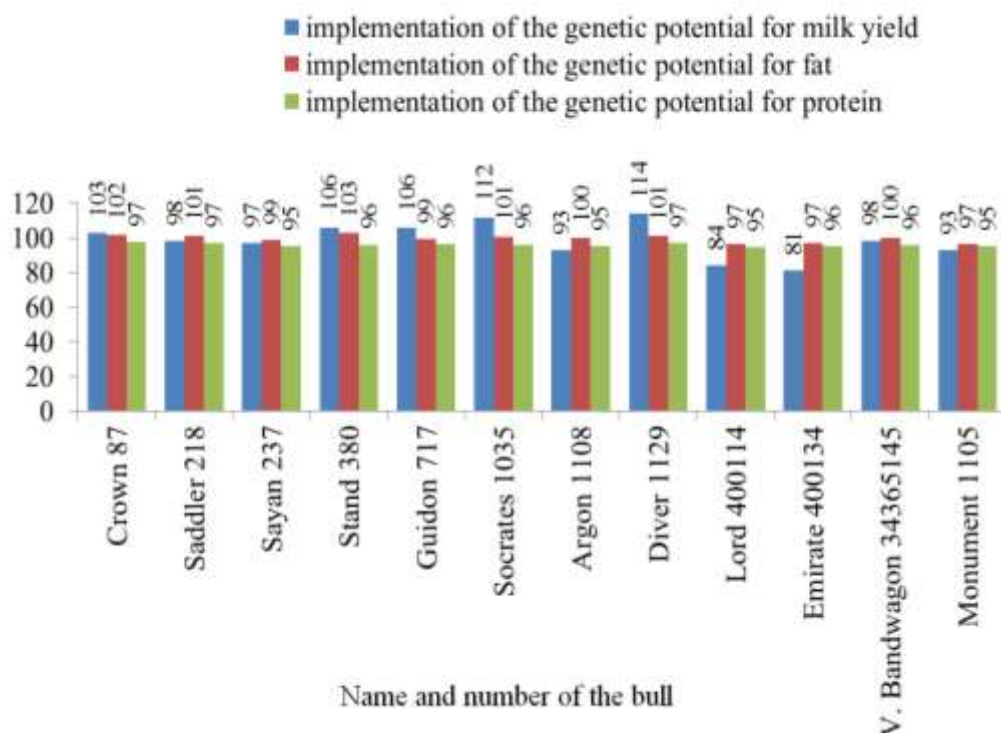
The coefficient of variation in the mass fraction of protein in animals, depending on the value of the parent index, ranged from 3.2 to 7% per 1 lactation. The coefficient of variation of the mass fraction of protein for maximum

lactation is from 2 to 6.6%. The coefficient of variation of the protein mass fraction on average for a number of lactations is from 0.5 to 4.6%.

**Table 3:-** Effect of genetic potential on the mass fraction of cow protein.

Parent index for cows by mass fraction of protein, %	n	Mass fraction of protein, %								
		for 1 lactation			the highest lactation			the average lactation		
		M	m	Cv, %	M	m	Cv, %	M	m	Cv, %
3,00 or less	14	3,01	0,025	3,2	3,08	0,027	3,3	3,03	0,004	0,5
3,01-3,10	100	3,01	0,014	4,6	3,08	0,012	3,7	3,03	0,014	4,6
3,11-3,20	151	3,01	0,007	2,9	3,08	0,005	2,0	3,03	0,002	0,7
3,21-3,30	48	3,03	0,020	5,2	3,09	0,010	2,7	3,04	0,010	1,5
3,31 or more	39	3,09	0,030	7,0	3,14	0,030	6,6	3,05	0,010	1,8

Studying the influence of the genetic potential of cows of different genotypes on the level of milk productivity, it was found that the daughters of bulls Stand 380 and Diver 1129 had the highest milk yields for maximum lactation - 7004 kg and 7071 kg (respectively) and had a high genetic potential – 6630 kg and 6191 kg. It should be noted that the realization of the genetic potential for milk yield in these groups was 106% and 114%. The daughter's genetic potential is high: Socrates 1035-112%, Guidon 717-106%, and Crown 87-103%. The daughter's genetic potential is low: Emirate 400134– 81%, Lord 400114 – 84%. The realization of the genetic potential for fat content of milk from cows of different origin ranged from 97 to 103%. The realization of the genetic potential for protein content ranged from 95 to 97%. The daughters of bulls realized their genetic potential better than others in terms of the mass fraction of fat: Stand 380, Crown 87, Diver 1129, Saddler 218, Socrates 1035, Argon 1108, V. Bandwagon 34365145. The daughters of bulls realized their genetic potential better than others in terms of the mass fraction of protein: Crown 87, Saddler 218, Diver 1129 (figure 1).



**Figure 1:-** Realization of the genetic potential of cows depending on their origin, %.

The research objectives were to study the degree of realization of the genetic potential of cows depending on their linear affiliation.

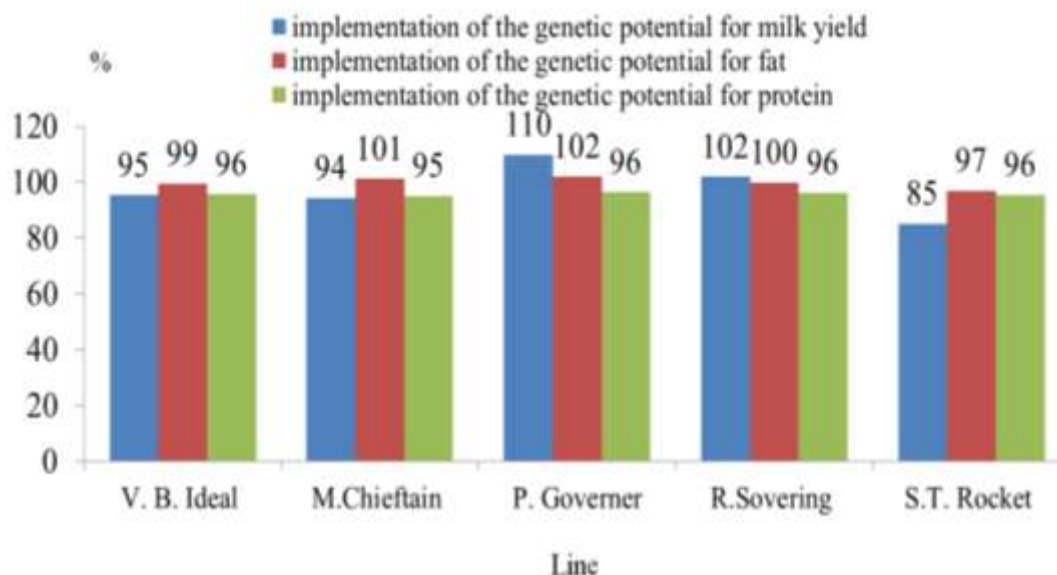
A number of paratypical factors influence the realization of the genetic potential, the main of which are the feeding and maintenance conditions. It is necessary to determine its realization by black-and-white cows in the conditions of the Prigorodny Agricultural production cooperative.

As a result of the research, it was found that the realization of the genetic potential in animals of different lines in terms of milk yield ranged from 85% to 110% (figure 2). The genetic potential was realized by the animals of the Pubst Governor 882933 and Reflection Sovering 198998 lines-by 110% and 102% (respectively). Cows of the S. T. Rocket 252803 line failed to realize their genetic potential. The implementation of the genetic potential was only 85%.

The realization of the genetic potential of the mass fraction of fat in cows, depending on the linear affiliation, ranged from 97% (line S. T. Rocket 252803) to 102% (line Pubst Governor 882933).

The realization of the ancestral potential for protein content in cows, depending on their lineage, ranged from 95-96%.

As a result of research, it was found that the dairy productivity of cows, depending on the genetic potential, has differences. It was revealed that the parent index has an impact on quantitative and qualitative indicators of milk productivity.



**Figure 2:-** Implementation of the genetic potential of animals of different lines.

### Conclusion:-

As a result of research, the influence of the genetic potential of cows on the level of milk productivity was established. It was found that the highest level of productivity was observed in cows whose parent index was more than 9000 kg, in terms of fat mass fraction-more than 3.8%, in terms of protein mass fraction-3.31% or more. As a result of research, it was found that the realization of the genetic potential for milk yield in animals of different lines ranged from 85% to 110%. Pubst Governor 882933 and Reflection Sovering 198998 realized their genetic potential by 110% and 102% (respectively). The realization of the genetic potential of the mass fraction of fat in cows, depending on the linear affiliation, was at a high level - from 97% (line S. T. Rocket 252803) to 102% (line Pubst Governor 882933).

The realization of the ancestral potential for protein content in cows, depending on their lineage, ranged from 95-96%.

The daughters of the bulls of Stand 380 and Diver 1129 had the highest yields for maximum lactation - 7004 kg and 7071 kg (respectively) and had a high genetic potential – 6630 kg and 6191 kg. The realization of genetic potential in these groups was 106% and 114%. High realization of the genetic potential of the daughter of Socrates 1035-112%, Guidon 717-106% and Crown 87 -103%.

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