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Comparative analysis of dairy cows' productivity depending on their origin and perspectives of further stock breeding in the herd

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Abstract. Analysis of the dairy productivity of cows of various origins was made in the APC Kolkhoz Prigorodny. In this farm they breed cattle of black-motley breed. All the cattle stock in the farm are purebred and high-quality, the dairy efficiency of cows is at a fairly high level. In the herd there are cows of five genealogical lines: Vis Back Ideal, R. Sovereign, Mont-week Chieftain, S.T. Rocket, Pubst Governor. As research has shown, cows of the Pubst Governor line were the leaders by milk yield, and the cows of the S.T. Rocket line had the most fat-milk. The cows of the lines Vis Back Ideal and Mont-week Chieftain possessed the highest content of protein mass fraction. As a result of the research it was found out that among the considered population cows were lactated by daughters of 33 bulls. All bulls, whose bioproducts were used in the farm were purebred, had an elite-record class. Proceeding from the possibilities of the farm economy, a tribal nucleus in the dairy herd was identified, and a selection boundary of characteristics was established. Further measures of selection and breeding work with the herd have been developed.

1. Introduction

Stock breeding of dairy cows has been attracting greater attention recently. The qualitative development and the formation of highly-productive herds is the main task in this work. Stock breeding, developing biological production, facilitates a stable growth of their genetic potential, contributes to the increasing performance efficiency and quality improvement [1–3]. The main objective of stock breeding planning is to outline effective ways of the quickest improvements of animals in the herd due to their useful features [4–6]. In addition, animals selected for further development must be the best in the herd from the point of their origin and milk productivity [7, 8]. According to some researchers [9–11], the origin of dairy cows influences the effectiveness of stock breeding in milk productivity. Thus, stud bulls provide 90-95 % of selective effectiveness in the breed. Linear type traits of cows produce a remarkable effect on milk productivity indexes the level of which varies within a broad range. Taking into consideration the abovementioned, the objective of the article is a comparative analysis of dairy cows' productivity belonging to different linear types and perspectives of further stock breeding of the herd in the Agricultural Productive Cooperative Kolkhos Prigorodny.



2. Experimental

The research was done in the Agricultural Productive Cooperative Kolkhos Prigorodny in Medvedevo region of the Republic of Mari El. The object of the research was 515 Goldstein cows of a black-and-white breed. The objective of the research is a comparative analysis of dairy cows' productivity belonging to different linear types and perspectives of further stock breeding of the herd.

3. Results and Considerations

Goldstein cows of black-and-white breed are ranches in the Agricultural Productive Cooperative Kolkhos Prigorodny. The herd is purebred and of high quality: 98.8 % belong to the elite-record class, 1.2 % – to the elite class. Significance tests are annually performed in the collective farm to perform immune-genetic testing of the breeding stock, 55.7 % of it had been tested.

The herd in the collective farm is young. An average age of cows in lactation is 3.2 calvers. The research shows that milk yield was growing together with the age of cows to the 3 lactation with the maximum meaning of 6072 kg then followed by a gradual productivity fall.

It has been observed that milk productivity is on a respectively high level: yield – 5845 kg, the fat mass fraction– 3.94 %, proteins – 3.05 %, fat content in milk – 230.3 kg, milk proteins – 178 kg. Variability of the features in milk yield amounted to 11.9 %, the fat mass fraction– 2.5 %, the protein mass fraction – 1.5 %, fat content in milk – 12.5 %, milk proteins – 12.1 %. It means that the herd is homogeneous according to the features of milk productivity.

There are 63 milk cows (12.3 %) in the herd producing more than 7000 kg of milk. The record belongs to Egoza cow of type Mont-week Chieftain 95679, an offspring of Hazar 544. She gave 8744 kg with 3.95 % the fat mass fraction during 305 days of the 2 lactation.

In the collective farm Prigorodny cows of five genealogical lines are ranches (figure 1). V.B. Ideal 1013415 is the most numerous with 170 heads (48.6 %). The type Reflection Sovereign 198998 is the second one with 118 heads (33.7 %). The animals of other types in the herd structure take 17.7 %, including: Mont-week Chieftain 95679 – 8.9 %, S.T. Rocket 252803 – 7.1 %. The least numerous but a promising one is the type Pubst Governer 882933.

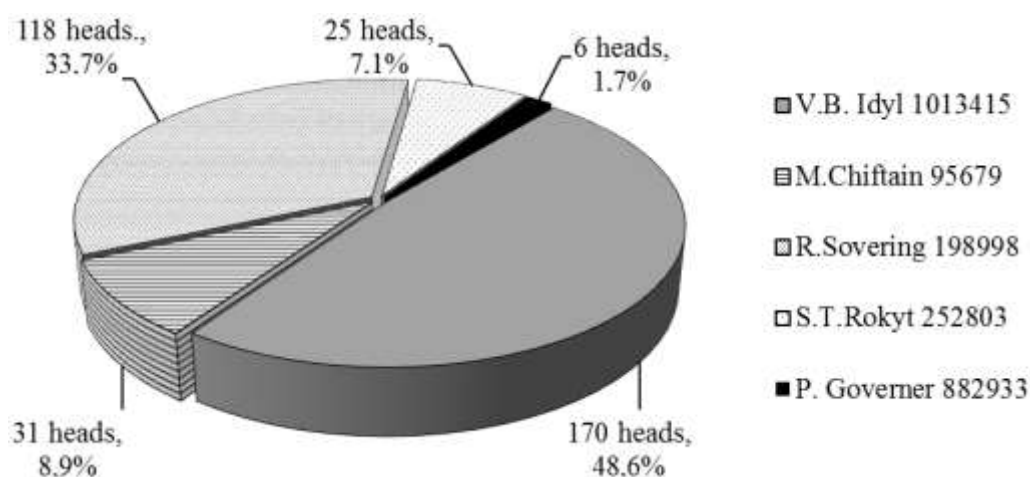


Figure 1. Genealogical structure of the herd in the Agricultural Productive Cooperative Kolkhos Prigorodny.

The research indicated that the cows of the linear type Pubst Governer 882933 were leading in milk yield which amounted to 6476 kg in the period of 305 days in the last lactation which is 574 kg higher than of those belonging to linear type V.B. Ideal 1013415, 788 kg higher than of those belonging to linear type Mont-week Chieftain 95679 ($P \leq 0.05$), 654 kg – of Reflection Sovereign 198998, 878 kg ($P \leq 0.01$) – S.T. Rocket 252803. The cows of linear type S.T. Rocket 252803 gave milk with the

highest fat content – 3.97 %. The cows of linear types V.B. Ideal 1013415 and Mont-week Chieftain 95679 had the highest the protein mass fraction – 3.05 % (Table 1).

Variability rate of milk productivity, depending on a linear type, amounted to: 9.5 % - 15.2 % for milk yield, 2.3 % - 3.1 % for weight percentage of fat content, 0.6 % - 2.3 % for the protein mass fraction.

The use of best stud bulls of native and international breeding is a prospective line of development.

It has been found out that daughters of 33 bulls lactated in the herd. All the bulls, bioproduct of which was used, were purebred of elite-record class. Ten bulls are registered in the State stud books. Four bulls have an international TPI index. Three bulls have a quality category on milk yield, one – on fat content. Stud bulls result from highly productive ancestors. Their mothers' productivity changed from 5434 kg to 16173 kg in milk yield, from 3.00 % to 4.51% – in weight percentage of fat content, from 2.79 % to 3.62 % – in the protein mass fraction. Productivity of fathers' mothers was higher: their yield amounted to 6871-16691 kg, the fat mass fraction – 3.5 % - 4.94 %, the protein mass fraction – 3.1 % - 3.71 %.

Table 1. Milk productivity of cows of different linear types.

Linear type	n	Milk yield, kg		The fat mass fraction		The protein mass fraction	
		M±m	Cv,%	M±m	Cv,%	M±m	Cv,%
V.B. Ideal 1013415	170	5902±49.6	10.9	3.93±0.006	2.3	3.05±0.003	1.3
Mont-week Chieftain 95679	31	5688±155.0	15.2	3.95±0.02	3.1	3.05±0.010	2.3
Reflection Sovereign 198998	118	5822±66.6	12.4	3.93±0.008	2.5	3.04±0.004	1.5
S.T. Rocket 252803	25	5598±106.0	9.5	3.97±0.02	3.1	3.02±0.010	2.0
Pubst Governor 882933	6	6476±370.0	14.0	3.93±0.04	3.1	3.04±0.007	0.6

As far as the number of heads is concerned, the daughters of the following bulls dominated in the herd: of S.V. Bandvagon 134365145 – 36 cows, of Socrat 1035 – 26 cows, of Gvidon 717 – 25 cows, of Shornik 218 – 20 cows (Table 2).

It has been observed that Korf 2774's daughters during 305 days of the last lactation had the highest yield amounting to 6660 kg. They were followed by Diver 1129's daughters, and the third place belonged to Motivation 120086092's daughters with productivity of 6495 kg and 6489 kg respectively.

It should be mentioned that Korf 2774's daughters actually had better results for this index of the following offspring: Rozhok 240's – by 1642 kg ($P \leq 0.001$), Sotrudnik 198's – by 1590 kg ($P \leq 0.001$), Muscat 2806's – by 1477 kg ($P \leq 0.001$), Start 1761's – by 1451 kg ($P \leq 0.001$), Baron 1566's – by 1442 kg ($P \leq 0.001$), Azimut 281's – by 1329 kg ($P \leq 0.001$), Boing 950's – by 1311 kg ($P \leq 0.001$), D. Spirit 135363258's – by 1290 kg ($P \leq 0.001$), Zhigan 7649's – by 1254 kg ($P \leq 0.001$), bull No.1659 – by 1251 kg ($P \leq 0.001$), Samorodok 343's – by 1234 kg ($P \leq 0.001$), bull No. 147 – by 1088 kg ($P \leq 0.001$), Punsh 1797's – by 1074 kg ($P \leq 0.001$), bull No.2118 – by 1547 kg ($P \leq 0.01$), Recket 1547's – by 904 kg ($P \leq 0.01$), Mirny 3209's – by 846 kg ($P \leq 0.01$), S.V. Bandvagon 134365145's – by 872 kg ($P \leq 0.01$), Sem 1385's – by 706 kg ($P \leq 0.01$), Stromo – M 463041's – by 1254 kg ($P \leq 0.01$), Gvidon 717's – by 658 kg ($P \leq 0.01$), Lindly 129449111's – by 801 kg ($P \leq 0.01$), Shornik 218's – by 618 kg ($P \leq 0.01$), Sokrat1035's – by 904 kg ($P \leq 0.01$).

The daughters of bull No. 147 gave milk with the highest fat content (the FMF – 4.08 %). Muscat 2806's offspring gave milk with the highest protein content (the PMF – 3.15%).

On the basis of the collective farm's possibilities the nuclear stock in the herd was formed, taking into consideration an offspring yield, herd replacement, and breeding sales of a young stock, since a collective farm is a breeding reproducer. While choosing a nuclear stock, a breeding limit was established – a minimal meaning of the trait. Cows, having higher than average indexes, can be

included into the nuclear stock, i.e. 5845 for yield and 3.92 % – for the fat mass fraction. 314 cows (approximately 61 %) show these results. The nuclear stock's average yield amounted to 6164 kg, the fat mass fraction – 3.94 %. Yield selection differential amounted to 319 kg, of the fat mass fraction – 0.01 %. It is known that the higher this index is, the greater is the possibility of getting highly productive offspring from the nuclear stock.

Table 2. The cows' milk productivity depending on their father's genotype.

Father's nickname and number	n	Yield, kg			FMF,%			PMF,%		
		M	m	Cv,%	M	m	Cv,%	M	m	Cv,%
Azhur 1208	3	6002	80.3	2.3	4.01	0.041	1.6	3.05	0.03	1.5
Azimet 281	7	5331	160.0	7.9	3.94	0.032	1.1	3.04	0.01	1.3
Argon 1108	12	6269	180.5	9.98	4.02	0.021	1.6	3.05	0.007	0.8
Baron 1566	12	5218	152.2	10.1	3.93	0.021	1.8	3.01	0.01	1.9
Boing 950	5	5349	243.6	10.2	3.96	0.021	1.4	3.05	0.02	1.6
Venets 87	12	6126	137.0	7.7	3.96	0.010	1.4	3.06	0.009	1.1
Gvidon 717	25	5954	85.3	7.1	3.91	0.022	2.2	3.05	0.004	0.8
Grey 1350	13	6118	136.2	8.0	3.95	0.011	1.2	3.06	0.010	1.2
Diver 1129	15	6495	202.4	12.0	3.97	0.011	1.2	3.05	0.008	1.1
D.Spirit 135363258	5	5370	118.2	4.9	3.79	0.021	1.6	3.04	0.005	0.4
Zhigan 7649	5	5406	497.6	20.6	4.02	0.021	1.4	3.01	0.01	0.8
Korf 2774	2	6660	302.9	6.4	4.03	0.062	2.2	2.99	0.003	0.2
Lindly 129449111	4	5990	465.5	15.2	3.94	0.021	1.4	3.0	0.01	1.0
Mirny 3209	18	5788	173.9	12.7	3.95	0.022	2.5	3.02	0.01	1.7
Motivation 120086092	7	6489	382.0	16.0	3.94	0.021	1.3	3.06	0.02	1.7
Muscat 2806	5	5183	307.0	13.0	3.87	0.095	5.0	3.15	0.06	4.0
Prestige 731	3	6425	450.6	12.1	3.86	0.062	2.5	3.04	0.03	1.8
Punsh 1797	9	5586	246.8	13.2	3.99	0.021	1.9	3.04	0.01	1.2
Recket 1547	16	5756	140.0	10.0	4.00	0.032	2.9	3.04	0.02	2.1
Rozhok 240	4	5018	220.4	8.8	3.85	0.105	5.0	2.98	0.01	0.9
S.V. Bandvagon 134365145	24	5814	90.0	7.6	3.87	0.022	2.7	3.05	0.01	0.9
Samorodok 343	14	5426	227.0	15.7	3.94	0.032	2.6	3.01	0.01	1.6
Sema 1385	8	5859	244.5	11.8	3.95	0.031	1.9	3.04	0.02	2.1
Socrat 1035	26	6042	118.4	10.0	3.93	0.022	2.7	3.05	0.01	1.2
Sotrudnik 198	4	5070	163.4	6.4	3.96	0.031	1.7	3.02	0.04	2.9
Start 1761	2	5209	335.5	9.1	4.02	0.010	1.5	3.02	0.01	0.5
Stand 380	6	6476	370.0	14.0	3.90	0.053	3.0	3.04	0.01	0.6
Stromo-M 463041	3	5874	100.7	3.0	3.89	0.083	3.7	3.04	0.01	0.8
Frederick 18016881	6	6289	302.4	11.8	3.91	0.021	1.4	3.07	0.01	0.8
Shornik 218	20	5991	145.0	10.8	3.89	0.022	2.5	3.06	0.01	1.1
147	4	5572	326.4	11.7	4.08	0.073	3.6	3.06	0.02	1.5
1659	6	5409	374.0	16.9	3.86	0.084	4.9	3.07	0.03	2.6
2118	10	5681	282.3	11.1	4.04	0.073	3.6	3.05	0.01	0.6

At the present time, the collective farm is working at breeding traits that have the greatest economic importance: milk yield and the fat mass fraction. But in the future, an individual corrective breeding for the nuclear stock will be used. The insemination will be performed with bull semen on the basis of their offspring quality. Special attention will be given to cows' external appearance and a bull's linear type as they are closely connected with cows' reproductive functions. The external

appearance parameters of a highly productive type of a cow, which will be taken into consideration in planning parents' pairs, have been described by the authors.

The selection process of parents' pairs in the Agricultural Productive Cooperative Kolkhos Prigorodny begins with the analysis of the cows' and bulls' origin. The genetic evaluation of ancestors from the father's line is under examination. Stud bulls must be the best in the herd and the acknowledged improvers of not only productivity but also of a figure type of their daughters and obligatorily – of the udder and the limbs. Grandparents (fathers' fathers) must also possess positive breeding qualities. Bulls' mothers must be distinguished by perfect constitution and have a high level of milk productivity: not less than 10,000 kg for yield, not less than 3.92 % for the fat mass fraction, not less than 3.2 % for the protein mass fraction. Stud bulls are evaluated on the basis of their daughters' external appearance as this evaluation allows improving external appearance of the future offspring.

4. Summary

In conclusion, as a result of the research it has been found out that in the Agricultural Productive Cooperative Kolkhos Prigorodny the Goldstein cows of black-and-white breed are ranches. The herd is purebred, of high quality class. Milk productivity is also at a respectively high level: yield – 5845 kg, the fat mass fraction – 3.94 %, the protein mass production – 3.05%, fat content in milk – 230.3 kg, milk proteins – 178 kg. In the collective farm Prigorodny cows of five genealogical lines are ranches. V.B. Ideal 1013415 is the most numerous with 170 heads (48.6 %). The type Reflection Sovereign 198998 is the second one with 118 heads (33.7 %). The research indicated that the cows of the linear type Pubst Governor 882933 were leading in milk yield which amounted to 6476 kg in the period of 305 days in the last lactation. The cows of linear type S.T. Rocket 252803 gave milk with the highest fat content – 3.97 %. The cows of linear types V.B. Ideal 1013415 and Mont-week Chieftain 95679 had the highest the protein mass fraction – 3.05 %. The research indicated that stud bulls influence the level of their daughters' milk productivity. It has been observed that Korf 2774's daughters during 305 days of the last lactation had the highest yield amounting to 6660 kg and the fat mass fraction in their milk amounted to 4.03%. The daughters of bull No. 147 gave milk with the highest fat content (the FMF – 4.08 %). Muscat 2806's offspring gave milk with the highest protein content (the PMF – 3.15%). To make breeding more effective, cows having higher than average indexes can be included into the nuclear stock, i.e. 5845 kg for yield and 3.92 % – for the fat mass fraction. Secondly, an individual corrective breeding for the nuclear stock must be used. Thirdly, a bioproduct of the best bulls must be used in insemination taking into account to cows' external appearance.

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