RESEARCH REGARDING THE MILK QUALITY IN SURA DE STEPA BREED

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Abstract

Biological material studied is represented by 30 head of breed cows Sura de stepa, exploited in a semi-intensive system, calves linked to SCDCB Dancu, Iasi. The importance of this core is mainly scientific interest related to the maintenance pedigree bred and owned by the great historical role in the formation of improved breeds in our country. With the disappearance of the breed would disappear and a number of special features such as adaptability, particularly in disease resistance, high percentage of fat in milk, etc. In first lactation was achieved 62.69% of the maximum lateness value showing Sura de stepa breed for milk production. The amount of milk ranged between 1589.64 kilograms (lact. I) and 2535.43 kilograms of you who are lactating and maximum lactation. From the sixth lactation milk quantity SCAT, reaching lactating VIII value of 1078.5 kg. Percentage of fat in lactation to achieve maximum value 4.71% that will. The same trend is observed and the percentage of protein in lactation of you has a value of 3.71%. Variability in the characters mentioned is intermediate to high (V = 6.09 to 12.06%) which provides a wide field of population improvement through selection and training of lines for quantitative and qualitative indicators of milk production. Also, the race Sura de stepa were revealed following systems polymorphous protein: alpha-casein S_1 (αS_1-cz), beta-casein (β-cz), kappa-casein (K-cz), beta-lactoglobulin (β - lg), alpha-lactoglobulin (α-la) and alpha-casein S_2 (αS_2-CZ). The system αS_1-cz allele, as_1-Cn B has the highest frequency, the system β-cz, allele β-Cn A^2 into the K-cz, k-Cn B allele frequency is highest, the system β - lg, as heterozygous AB has the highest frequency - alleles were balanced into the α-la, meets monomorfism for allele α-La B and similar to the system in αS_2-cz for allele α_{s2}-Cn A.

Key words: race, quality, milk, genetic conservation

INTRODUCTION

It is currently known that the modern society is facing numerous essential problems for mankind's future, problems that emerge as a result of the disproportion between the unprecedented demographic explosion and the natural resources which in certain areas are fast diminishing and degrading following the unhealthy exploitations. Consequently, the issue of preserving the environment has come up as an acute necessity present on the agenda of many governments and international bodies.

Sura de stepa breed, which is on the verge of extinction, has been included in a preservation programme for animal genetic resources (Creangă Şt. et al. [2]), being raised in a reduced nucleus at the Station for Research and Development of Cattle Husbandry – Dancu Iaşi (S.C.D.C.B. Dancu Iasi). It is a non-meliorated breed coming from the original form Bos taurus primigenius. The formation of the breed is tightly related to the environment where the keeper has very little contributed.

Due to the fact that this breed evolved in the middle of the nature, both in summer and winter, the environment gave it exceptional features of hardiness, a capacity to adapt and turn to good use the fibrous fodder, health, a special resistance to diseases and bad weather. If from the productive viewpoint it no longer satisfies the current demands, this breed may play a historical, tourist and genetic role in the future (as a source of valuable genes), all these features being a decisive argument to preserve Sura de stepa breed. Some characters such as the high fat content of milk, hardiness, adaptability, resistance to diseases and bad weather and the traditional exploitation systems might prove useful one day.

MATERIAL AND METHOD

Researches were carried out on 30 Sura de stepa cows raised in semi-intensive stalling system at S.C.D.C.B. Dancu, Iaşi. For this nucleus we studied the milk production with qualitative indicators (percentage of fat and protein) by successive lactations and the main lactoprotein systems. To determine the phenotypic parameters, we used the statistical calculation typical for such researches $\overline{X}$, $\pm s\bar{x}$, s, V%, the variation series and regression line (Maciuc V. et al. [6]). The study of polymorphism of milk proteins for the members of the Bovidae family of Sură de Stepă breed was effectuated by PCR-RFLP technique, and for the study of polymorphism of all bovine lactoproteins we also used the isoelectric focusing technique (IEF).

The milk samples were taken-off individually in 15 ml Falcon tubes, were transported at 4^0 C and then frozen at -20^0C until the running of tests. Defreezing took place at room temperature and subsequently the samples were centrifuged at 8.000 rotations / minute for 5 minutes for milk separation. They were stored for 30 minutes at 4 degrees for fat to solidify which then was removed from every tube by means of a spatula (Creangă Şt. et al. [1]).

For an optimum protein concentration, the samples were diluted with a solution of urea and β-mercaptoethanol. The samples were migrated into a polyacrylamide gel with a concentration of 4%. After migration the gel was immersed into a solution 10% of trichloroacetic acid. Colouring took place for 2 hours by means of a solution of 0.025% Coomassie Brilliant Blue R-250 in 40% ethanol and 7% glacial acetic acid.

RESULTS AND DISCUSSIONS

In table 1 we present the average values and variability of milk production indices, by successive lactations, for Sura de stepa breed. The length of total lactation is also the length of normal lactation, since the period of lactation of 305 days is not exceeded. The milk quantity per lactation varied between 1589.64 kg (1st lactation) and 2535.43 kg in the 5th lactation which is also the maximum lactation. Starting from the 6th lactation, the milk quantity decreases and in the 8th lactation it reached the value of 1078.5 kg.

In the first lactation 62.69 % of the maximum lactation was achieved, a value highlighting the tardiness of the Sura de stepa breed in terms of milk production. The variability of the milk quantitative production is very strong, the values of standard deviation ranging between s = 544.10 kg of milk in the 1st lactation and 1185.89 kg of milk in the 5th lactation, and the variability coefficients between V % = 36.43 and V % =46.77. The very strong variability of the nucleus under study proves the lack of selection according to this basic parameter and the possibility of genetic melioration by withholding and multiplying the valuable genotypes. Mention must be made that in the nucleus under study there were individuals with a maximum production of 4080 kg or 3080 kg of milk per lactation.

In the genetic structure of the livestock under study, we identified three groups of paternal semi-sisters with productions of 1548.22 kg (code 79009) and 1752.33 kg (code 79005), quite low values in terms of milk quantity. We also noticed a good corporal development of the genetic groups with body weight values between 626.67 kg (code 79005) and 549.38 kg (87027). These data are favorable for the selection of the nucleus under study for the melioration of the meat production of Sura de stepa breed.

AS for the qualitative features of milk (Maciuc V. et al. [7]), the fat percentage reaches the maximum value in the 5th lactation, namely 4.71%. The same evolution may also be noticed for the protein percentage that in the 5th lactation reaches 3.71%. The variability of the indicators mentioned above is intermediate to high (V = 6.09 – 12.06 %).

The fat and protein quantity has a similar evolution to that of milk production due to the tight relation existing between these characters (r_{pg} = 0.75 – 0.99). We must also mention the high variability of the specified indicators highlighting the heterogeneity of the nucleus under study.

Table 1
Average values and variability of milk production indices, by successive lactations, for Sura de Stepa breed

Specification	Statistics	Normal lactation				
		Kg Milk	% fat	Kg fat	% prot	Kg prot
1st lactation	n	30	30	30	30	30
	$\overline{X}$	1589.64	4.64	68.94	3.53	49.95
	$\pm s\overline{x}$	102.82	0.09	4.67	0.053	3.447
	s	544.10	0.49	24.74	0.242	15.794
	V%	36.43	11.21	37.48	6.86	31.60
	Min	360	3.40	15.00	3.07	27
	Max	2612	5.30	107.00	3.91	77
2nd lactation	n	27	27	27	27	27
	$\overline{X}$	1699.96	4.65	67.04	3.56	54.65
	$\pm s\overline{x}$	147.15	0.09	5.09	0.053	3,.915
	s	705.71	0.45	24.42	0.236	17.509
	V%	41.58	9.88	33.43	6.62	32
	Min	198	3.70	10.00	3.08	17
	Max	3565	5.40	111.00	3.90	99
3rd lactation	n	20	20	20	20	20
	$\overline{X}$	2092.80	4.51	93.00	3.59	64.75
	$\pm s\overline{x}$	215.08	0.12	8.76	0.053	3.915
	s	833.01	0.49	33.95	0.236	17.509
	V%	39.80	10.85	36.50	6.82	31.73
	Min	434	3.50	22.00	3.18	29
	Max	4080	5.30	144.00	3.90	99
4th lactation	n	15	15	15	15	15
	$\overline{X}$	2082.10	4.62	91.10	3.65	70.51
	$\pm s\overline{x}$	250.46	0.13	9.71	0.064	9.237
	s	792.03	0.41	30.72	0.222	31.998
	V%	38.04	8.94	33.72	6.09	45.40
	Min	835	4.10	45.00	3.21	30
	Max	3080	5.30	138.00	4.09	130
5th lactation	n	8	8	8	8	8
	$\overline{X}$	2535.43	4.73	119.92	3.71	69.14
	$\pm s\overline{x}$	448.22	0.21	25.25	0.038	6.753
	s	1185.89	0.57	66.82	0.10	16.541
	V%	46.77	12.06	54.01	2.69	37.60
	Min	675	3.70	32.00	3.59	25
	Max	4087	5.30	212.00	3.88	95
6th lactation	n	5	5	5	5	5
	$\overline{X}$	1411.00	4.95	69.00	3.58	39
	$\pm s\overline{x}$	201.67	0.15	9.28	0.103	7.348
	s	403.35	0.31	18.56	0.253	18
	V%	28.58	6.28	26.90	7.06	46.20
	Min	818	4.60	43.00	3.08	22
	Max	1705	5.30	87.00	3.79	65
7th lactation	n	3	3	3	3	3
	$\overline{X}$	1519.00	4.66	83	3.54	68
	$\pm s\overline{x}$	270.46	0.13	9.71	0.038	6.753
	s	792.03	0.41	30.72	0.10	14.541
	V%	18.04	3.94	13.72	2.29	27.20
	Min	835	4.10	45.00	3.49	66
	Max	1980	5.30	138.00	3.58	71
8th lactation	n	2	2	2	2	2
	$\overline{X}$	1078.5	5.28	57.44	3.71	39
	$\pm s\overline{x}$	268.46	0.13	9.71	0.027	5.325
	s	792.03	0.41	30.72	0.15	12.72
	V%	12.04	2.94	10.72	2.14	15.10
	Min	875	5.19	45.00	3.69	39
	Max	1282	5.30	68.00	3.73	39

The variability of the qualitative indicators for milk production is presented in the tables and diagrams for the variation series (tab. 2- 4 and fig. 1-2).

For the percentage of milk fat, the module of population has a relative frequency of 27.59 % and belongs to the class 4.37 – 4.68 % fat. Consequently, the plus variants taken into account in the improvement of population are module (27.59 %) and the classes higher than module (4.69 – 5.00% and 5.01 – 5.32% fat). The fat quantity has several classes with high frequencies and the plus variants shall be established depending on the size of the reproduction group necessary for the improvement of population.

Table 2
Variation series for milk fat percentage in the 1st lactation

No. of class	Class	Absolute frequency	Relative frequency
1	3.08 – 3.4	1	3.45
2	3.41 – 3.72	1	3.45
3	3.73 – 4.04	3	10.34
4	4.05 – 4.36	5	17.24
5	4.37 – 4.68	8	27.59
6	4.69 – 5.00	7	24.14
7	5.01 – 5.32	4	13.79

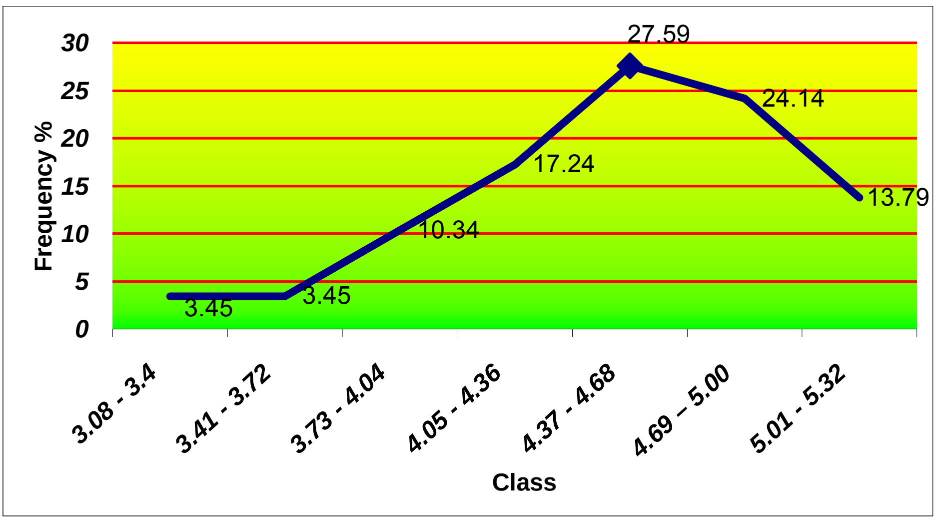

Fig.1 Polygon of frequencies for milk fat percentage in the 1st lactation

Table 3
Variation series for milk fat percentage in the 1st lactation

No. of class	Class	Absolute frequency	Relative frequency
1	25.3 – 36.97	3	10.34
2	36.98 – 48.64	5	17.24
3	48.65 – 60.31	3	10.34
4	60.32 – 71.99	5	17.24
5	72.00 – 83.66	5	17.24
6	83.67 – 95.33	5	17.24
7	95.34 – 107.00	3	10.34

Table 4
Variation series for milk protein percentage in the 1st lactation

No. of class	Class	Absolute frequency	Relative frequency
1	3.03 – 3.16	4	15.38
2	3.17 – 3.28	2	7.69
3	3.29 – 3.41	3	11.54
4	3.42 – 3.53	2	7.69
5	3.54 – 3.66	7	26.92
6	3.67 – 3.78	6	23.08
7	3.79 – 3.91	2	7.69

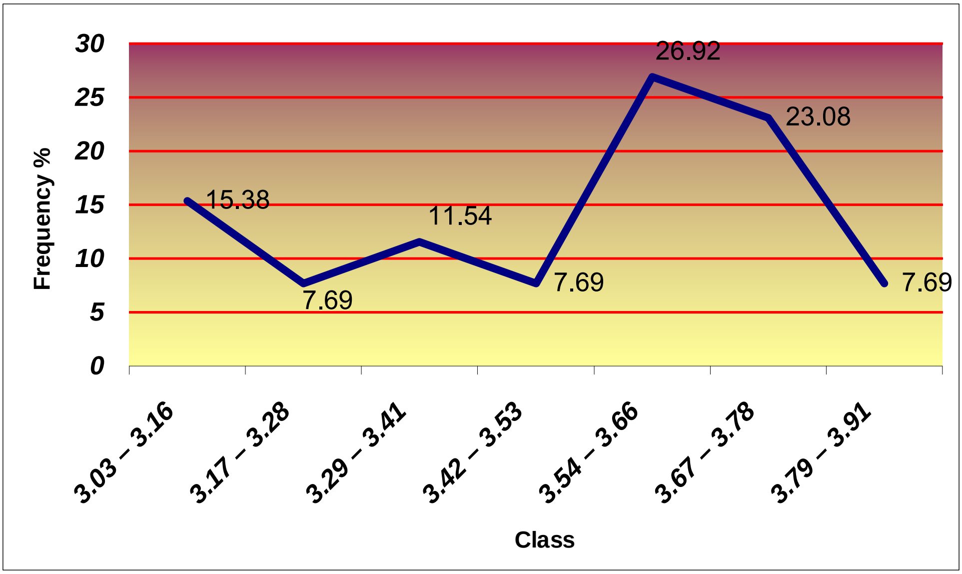

Fig. 2 Polygon of frequencies for milk protein percentage in the 1st lactation

In case of the percentage of milk protein, the module of population has a relative frequency of 26.92 % and belongs to the class 3.54 – 3.66% protein. Plus variants fall into module class and the classes are higher than module (3.67 – 3.78% and 3.79 – 3.91% protein).

The cows in the nucleus under study had a medium size of 122.28 cm and body weight 542.86 kg, values highlighting good body massiveness. For this character we notice plus variants reaching the weight of 710.00 kg.

The variability of the size is less accentuated, the lot under study being sufficiently homogenous (s = 3.06 cm, and V% = 2.51). In exchange, the body weight presents a high variability with dispersion indices s = 99.38 kg, and V % =18.30.

In figure 3, one may notice the alleles identified for the six loci codifying the six types of major milk proteins (α S1-cz; β-cz; K-cz; β-lg; α-la; α S2-cz).

The genetic structure for the polymorph systems of milk proteins: alpha-casein S_1 (αS1-cz), beta-casein (β-cz), kappa-casein (K-cz), beta-lactoglobulin (β-lg), alpha-lactoglobulin (α-la) and alpha-casein S_2 (αS2-cz) is given in table 5.

Casein α_{s1} – in our case α_{s1}-Cn B is more frequently met, as the specialized literature shows, with a higher frequency of 0.7 (Hekken, I., et al. [5]). For the yak, a high frequency is held by α_{s1}-Cn C, this being higher than 0.6. Also for the yak a quite high frequency (over 0.3) is held by a quire rare variant, α_{s1}-Cn E. Variant α_{s1}-Cn A has not been registered so far but for Holstein (Ng - Kwai - Hang et al. [9]) and the Danish Red breed. Variant α_{s1}-Cn D, encountered in Flemish breed (Grosclaude et al. [3]), has a very low frequency (around 0.01), being more frequently encountered to some French and Italian breeds.

Casein α_{s2} – is monomorphous at Sură de stepă breed as it can be noticed to all bovine breeds studied so far. A polymorphism (variant α_{s2}-Cn D) was underlined by Grosclaude [4] in 1987 for the breeds Montbéliarde and Vosgienne. In 1981, Mahe [3] highlighted the variants α_{s2}-Cn B and α_{s2}-Cn C for the Yak, the two variants having frequencies of 0.1 – 0.2.

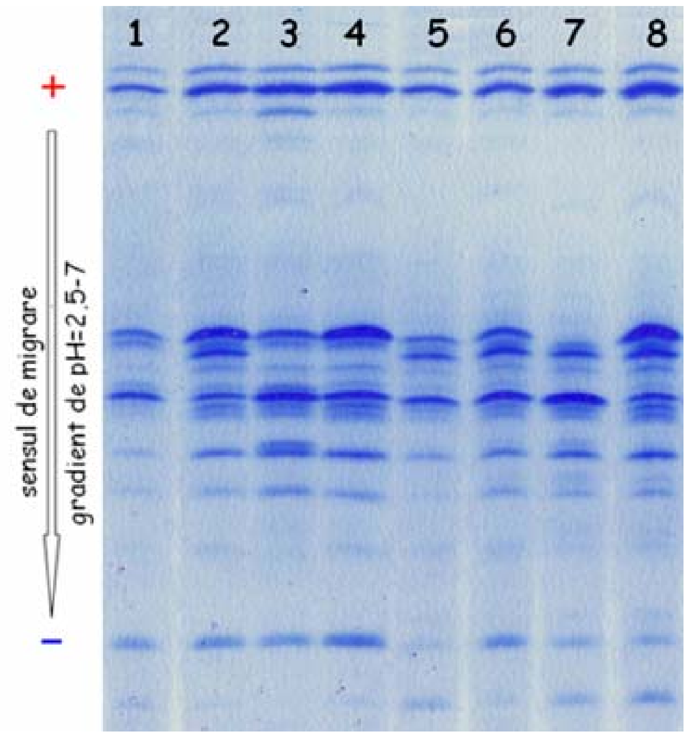

Fig. 3 IEF profile belonging to some individuals of Sura de Stepa breed from SCDCB Dancu, highlighting alleles of major milk proteins

Casein β – has the two universal variants β-Cn A_1 and β-Cn A_2, found in bovines and zebu. Variant β-Cn A_2 has a higher frequency in most breeds studied so far. Variant β-Cn A_1 has a higher frequency for the breeds coming from the North-West Europe, such as Holstein, Ayrshire, Shorthorn (Grosclaude and Mahe [3]) or for breeds related to these. Variant A_1 has a high frequency for the breeds of improved members of the Bovidae family.

The higher frequency of allele A_2 has a special significance since this allele is the ancestral one from which all the others derived phylogenetically. Variant β-Cn A_3 has a very low frequency being found in the breeds from North-West Europe, such as Holstein, Ayrshire and some French autochthonous breeds from Normandy.

Variant β-Cn B is also universally spread to the bovine breeds and zebu, but with a much smaller frequency. Only for Jersey breed its frequency is higher being close to 0.4.

Variant β-Cn C has a very low frequency for most European breeds and those from other continents (Hekken, I., et al. [5]).

They also discovered some very rare variants in diverse countries such as: β-Cn E in Italy, β-Cn B^2 in New Zeeland, β-Cn A^4 in Japan, Mongolic β-Cn A^3, in Mongolia (Grosclaude et al. [3]).

Kappa casein (K Cz). All researches undoubtedly proved the favorable influence of variant k-Cn B on milk quality and cheese quality (Răileanu V. [10], Mercier, J. C., et al. [8], Ribadeau-Dumas, B. [11]). That is why, in the study of bovine lactoproteins, most researches focused on determining the frequency of kappa – casein alleles for different breeds as well as the possibility of “limited” promotion by selection of the variant kappa casein B.

Table 4
Genetic polymorphism of milk proteins for Sură de stepă breed from S.C.D.C.B. Dancu Iaşi

Registration no.	α S1-cz	β-cz	K-cz	β-lg	α-la	α S2-cz
9991	BI^{RV}	A_1A_2	AB	AB	BB	AA
9993	BB	A_1A_1	BB	AB	BB	AA
9983	BB	A_1A_2	AB	AB	BB	AA
9988	BB	A_1A_2	BB	AA	BB	AA
0004	CI^{RV}	A_2A_2	AA	AB	BB	AA
9985	BC	A_1A_2	AB	AB	BB	AA
9990	BB	A_1A_2	BB	AA	BB	AA
9998	BC	A_2A_2	AB	AB	BB	AA
9723	BB	A_1A_1	BB	AB	BB	AA
9986	BC	A_2A_2	AB	AB	BB	AA
Genotype frequency	BB = 0.5 BC = 0.3 CI^{RV} = 0.1 BI^{RV} = 0.1	A_1A_1 = 0.2 A_1A_2 = 0.5 A_2A_2 = 0.3	AA = 0.209 AB = 0.416 BB = 0.375	AA = 0.292 AB = 0.500 BB = 0.208	BB = 1	AA = 1
Allele frequency	$p_B = 0.7$ $q_C = 0.2$ $r_{IRV} = 0.1$	$p_{A1} = 0.45$ $q_{A2} = 0.55$	$p_{A1} = 0.417$ $q_{A2} = 0.583$	$p_{A1} = 0.542$ $q_{A2} = 0.458$	$P_B = 1$	$p_A = 1$

Variants k-Cn A and k-Cn B are universally spread in bovines and zebu. Recently, they have also identified 3 more variants: k-Cn C, k-Cn D and k-Cn E, all of them having frequencies smaller than 0.1 and found only in some local breeds.

Variant k-Cn A has a higher average frequency in all breeds. Thus, for Holstein breed raised in different countries the frequency of k-Cn A ranges between 0.6 – 0.85.

Variant k-Cn B has a higher frequency in the breeds from Brună group, of different origins, with values between 0.4 and 0.6. For Jersey breed, the frequency of k-Cn B is also high (over 0.6). The higher frequency of k-Cn B in these breeds is positively correlated to a high percentage of milk protein and a higher productivity for cheese.

The lack of promotion by selection of k-Cn B triggers in time a reduction of its frequency.

As for the crossbreds of different breeds, the frequency k-Cn B is intermediate between the frequencies of pure breeds what shows the significant influence of crossbreeding in the transmission of the desired type of kappa-casein.

α-lactalbumin. Variants α-La A and α-La B exist apparently in most populations of zebu but in bovines one may encounter only the variant α-La B in almost all breeds. Variant α-La A, which is frequent in zebu, is less rare in the countries from Central and Meridional Europe and it can be found in 11 Italian breeds and some local Russian and Romanian breeds.

For banteng, they discovered a very rare variant α-La C this having the absolute frequency (1.0) in this breed.

β-lactoglobulin. Two variants, β-Lg A and β-Lg B, are universally spread in bovines and zebu. The repartition of the two variants in most breeds is quite balanced.

Variant β-Lg C is specific only to Jersey breed and β-Lg D, found in Montbéliarde breed (Graosclaude et al. [3]), later found in other European breeds too, seems to be specific only to the breeds with better aptitudes for meat. Both variants have very low frequencies under 0.1.

Though in phylogeny variant B is the one from which derived the other alleles known for this locus, the higher frequency of allele A demonstrates a certain work of improvement carried out for the breed to improve the milk quantity.

CONCLUSIONS

1. Sură de stepă breed, included in a preservation programme of genetic resources, has exceptional qualities of hardiness,

capacity of adaptation, turning to good account of fibrous fodder, health, resistance to diseases and qualitative milk with 4.71 % fat and 3.71% protein.

2. The cows from the nucleus under study had a medium size of 122.28 cm and body weight of 542.86 kg, values highlighting good body massiveness. For this character we may finf plus variants reaching the weight of 710.00 Kg.

3. For Sură de stepă breed we identified alleles for the six loci codifying the six types of major milk proteins (α S1-cz; β-cz; K-cz; β-lg; α-la; α S2-cz).

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