STUDY REGARDING MORPHOLOGICAL AND PRODUCTIVE FEATURES IN HIGH MILK PRODUCTION BLACK AND WHITE ROMANIAN COWS FROM S.C.D.C.B. DANCU, IASI

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Abstract

The study was made on 24 Black and White Romanian cows from S.C.D.C.B. Dancu, Iasi in 2008 . The purpose of our research was to monitor the level of milk production and the amelioration level of the population. The maximum production of milk was registered in the fourth lactation (7831.5Kg.) and the minimum production was registered in the third lactation (6692,84 Kg) showing a medium to large variability coefficient.

The corporal growth is good, with a medium value of 139 cm for hight and 617,75 Kg for weight.

The milk quantity has a medium genetic determinism (h^2=0.33) and the qualitative features have an intense genetic determinism (h^2=0,81 – 0,77). For corporal growth the heritability coefficient has an intermediate value (h^2=0,41 – 0,45).

The BNR population from S.C.D.C.B. Dancu Iasi has a good productive performance, these beeing improved through a continuity of selection activity and a minimization of the environmental features' influency, as well.

Key words: amelioration, heritability, variability

The milk yield regarding quantity and quality varies between bovine breeds depending on the level of genetic amelioration, exploitation directives and environmental conditions, being influenced by a group of internal (genetic, physiological) and external factors (environmental). Through these we mention specie, physiological type, breed, age, corporal conformation and development, constitution, temper, health. Environmental factors include feeding, water regime and quality, corporal hygiene, movement, milking and microclimate features.

In bovine breeding, the milk yield is very important, as the significant widening of the specialized dairy breeds within the past decades and the doubling of the milk production meanwhile prove it.

The amelioration of bovine milk production is a complex process, regarding its quantity and quality, as well. The main character used for selection criteria is the milk production for normal lactation. The total lactation is an informative character, which regards the milk quantity achieved within the postpartum-dry period interval per cow.

The literature in this domain indicates close values for genetic influence upon milk production, regardless of breed or amelioration level. It is appreciated that the general tendency for the above aspect is represented by low values for milk heritability, comparing higher values for heritability of milk quality.

This research has the purpose to analyze the morphological and productive features in a group of Black and White Romanian cows from SCDCB Dancu and to show the statistical values of the milk production variability on successive lactations/normal lactation, the corporal growth indices, heritability and repeatability coefficients for

quantity and quality production and phenotypic, genetic and environmental correlations between different characters.

MATERIAL AND METHOD

The biological material subject for this research was represented by a group of 24 dairy cows, Black and White Romanian breed, exploited in SCDCB Dancu-Iassy farm.

The following aspects were analyzed: the productive performance on four successive lactations for quantity and quality features, corporal growth and their genetic parameters (heritability, repeatability and correlation).

The primary data regarding the milk yield were taken from the farm records, the appreciation of the corporal growth was made using biometrical determinations and the genetic parameters were calculated with the REML method.

RESULTS AND DISCUTIONS

Analyzing the productive performance on four successive lactations at the cows from the research group, an average milk production of 6.755,83 Kg, with 4,14% fat and 3,3% protein for the first normal lactation has been found, with a variability value between 5.590 and 8.178 Kg of milk on an average period of 301,46 days.

The milk production in the second lactation slightly increased, having an average value of 7.164,17 Kg and similar values for qualitative indices with those from the previous lactation.

The third lactation had a lower milk production than the previous, an average of 6.692,84 Kg of milk (Table 1).

Estimating the corporal growth it has been found that that morphological parameters for studied cows registered the following average values: wither hight-139 cm., with variation limits between 133-146 cm, rump hight-140,75 cm, with variation limits between 132-149 cm, the thoracic perimeter -205,75 cm, with variation limits between 191- 230 cm and corporal weight-617,75 kg, with variation limits between 520-819 kg.

Our study has indicated an adequate corporal growth for dairy cow typology of high productivity, this aspect being observed from the analyze of calculated indices for: corporal format ($If_{c=119,80}$), skeleton ($I_{o=}$13,66) and underbrisket vacuum (I.v.s.=44,37), (table 2).

The values of heritability and repeatability coefficients regarding the milk yield (quantitative and qualitative) and environmental characters have been calculated for the same group of cows. Thus, the length of normal lactation and milk quantity had the following values for heritability coefficient: 0,29 respectively 0,33 and for repeatability coefficient of 0,22, showing average values of these indicators.

The characters of qualitative milk production, fat and protein percents had the following heritability values: 0,81and 0,77 respectively 0,79 and 0,68 for the repeatability, which demonstrate that these characters are strongly consolidated, have a high genetic influence and are slightly influenced by environment factors (environment variance). The characters of quantitative production for fat and protein had heritability values of 0,36 and 0,34 respectively 0,33 and 0,27 for repeatability values, indicating average values of these parameters.

The external characters showed the following values for heritability coefficient: 0,48 for the wither hight; 0,39 for total length; 0,41 for thoracic perimeter and 0,45 for corporal weight, being intense heritable (table 3).

The appreciation of the correlation between the analyzed characteres allowed their evaluation, if they were correlated or if the correlativity was assumed. The analyzing of genetic correlation of the characters by determining them in groups of related individuals allowed setting the correlation between cause-effect couples. The correlation manifestation is considered positive when the modification of a character attracts the modification of the other in the same direction and negative when it attracts the modification of the other in reverse.

Specification	No	Statistical parameters	Total lactation						Normal lactation					
			Lactation lenght days	Milk / kg	Fat.%	Fat./Kg	Prot.%	Prot.Kg.	Lactation lenght days	Milk / kg	Fat.%	Fat./Kg	Prot.%	Prot.Kg.
The first lactation	24	$\overline{X}$	382.58	8264.17	4.160	343.000	3.310	273.420	301.46	6755.83	4.140	280.54	3.300	223.920
		$\pm s_{\bar{x}}$	18.90	400.80	0.014	16.311	0.012	13.193	2.15	106.64	0.016	4.320	0.013	3.997
		s	92.61	1963.54	0.067	79.908	0.060	64.633	10.55	522.44	0.076	21.184	0.066	19.580
		V%	24.20	23.76	1.609	23.297	1.803	23.639	3.50	7.71	1.846	7.551	1.983	8.744
		Min	270.00	5590.00	4.060	244.000	3.130	181.000	270.00	5590.00	4.030	244.000	3.120	181.000
		Max	598.00	13044.00	4.360	541.000	3.410	435.000	305.00	8178.00	4.360	344.000	3.430	280.000
The second lactation	24	$\overline{X}$	379.79	8547.63	4.140	354.170	3.350	383.040	303.42	7164.17	4.140	296.460	3.340	238.170
		$\pm s_{\bar{x}}$	14.23	318.92	0.008	13.435	0.012	10.050	0.82	132.66	0.008	5.557	0.011	4.275
		s	69.72	1562.38	0.038	65.818	0.057	49.236	4.05	649.90	0.037	27.222	0.056	20.942
		V%	18.35	18.27	0.906	18.584	1.711	17.395	1.33	9.07	0.897	9.182	1.684	8.793
		Min	292.00	6082.00	4.090	254.000	3.130	206.000	292.00	5620.00	4.080	235.000	3.140	189.000
		Max	525.00	13309.00	4.250	556.000	3.410	417.000	305.00	8592.00	4.240	358.000	3.400	283.000
The third lactation	19	$\overline{X}$	347.16	7707.21	4.120	315.420	3.350	258.050	304.68	6692.84	4.110	285.420	3.340	231.530
		$\pm s_{\bar{x}}$	15.99	388.80	0.008	16.752	0.009	13.038	0.21	254.21	0.009	11.232	0.010	8.446
		s	69.73	1694.74	0.035	73.021	0.039	56.832	0.94	1108.10	0.037	48.960	0.042	36.814
		V%	20.08	21.98	0.858	23.150	1.171	22.023	0.31	15.84	0.912	17.153	1.270	15.901
		Min	302.00	4391.00	4.030	181.000	3.280	144.00	302.00	5035.00	3.980	181.000	3.280	144.000
		Max	533.00	10622.00	4.210	441.000	3.430	355.000	305.00	8739.00	4.160	363.000	3.440	294.000
The fourth lactation	3	$\overline{X}$	383.50	8916.00	4.160	346.000	3.370	300.000	305.00	7831.50	4.160	326.000	3.370	262.500
		$\pm s_{\bar{x}}$	77.50	2391.00	0.015	125.000	0.020	79.000	0	1322.50	0.020	56.000	0.025	42.500
		s	109.60	3381.38	0.021	176.777	0.028	111.723	0	1870.29	0.028	79.196	0.035	60.104
		V%	28.57	37.92	0.511	51.092	0.839	37.241	0	23.38	0.680	24.293	1.051	22.897
		Min	306.00	6525.00	4.140	221.000	3.350	221.000	305.00	6509.00	4.140	270.000	3.340	220.000
		Max	461.00	11307.00	4.170	471.000	3.390	379.000	305.00	9154.00	4.180	382.000	3.390	305.000

Table 1 The average values and the statistical data of milk production variability on successive lactation for our research dairy cows

Table 2
The statistical parameters of biometrical and corporal indices(cm)

Caracterul	No.	$\overline{X}$	±s $\overline{x}$	s	V%	Min	Max
hight	24	139.00	0.681	3.336	2.400	133.00	146.00
Back hight	24	139.58	0.725	3.550	2.543	133.00	147.00
Rump hight	24	140.75	0.774	3.791	2.693	132.00	149.00
Pin bone base hight	24	137.75	5.473	26.814	19.466	13.00	153.00
Thoracic depth	24	77.29	0.797	4.796	6.205	63.00	86.00
Brisket hight	24	61.71	1.154	5.653	9.161	53.00	77.00
Obliquity length	24	166.46	1.323	6.481	3.893	153.00	177.00
Horizontal length	24	137.00	1.925	9.432	6.884	125.00	174.00
Total length	24	213.58	1.666	8.161	3.821	196.00	232.00
Rump length	24	53.29	0.456	2.236	4.195	49.00	57.00
Thoracic length	24	89.17	0.827	4.050	4.543	84.00	97.00
Head length	24	52.00	0.276	1.351	2.599	49.00	54.00
Thoracic width	24	47.13	1.143	5.597	11.878	40.00	68.00
Brisket width	24	45.50	0.665	3.257	7.158	38.00	52.00
Rump width at hip bone	24	55.96	0.591	2.896	5.176	50.00	64.00
Rump width at hip joint	24	49.67	0.469	2.297	4.624	46.00	57.00
Rump width at ischium	24	20.38	0.268	1.313	6.442	18.00	23.00
Head width	24	21.71	0.185	0.908	4.182	20.00	24.00
Thoracic perimeter	24	205.75	1.772	8.679	4.218	191.00	230.00
Shin perimeter	24	18.98	0.174	0.853	4.495	17.00	21.00
Corporal weight -kg	24	617.75	13.257	64.944	10.513	520.00	819.00
IFC	24	119.80	1.064	5.212	4.350	109.28	132.33
IM	24	148.04	1.143	5.597	3.781	139.01	157.89
IO	24	13.66	0.123	0.602	4.408	12.68	14.66
IVS	24	44.37	0.738	3.616	8.149	39.42	55.00
IAC	24	36.46	0.490	2.40	6.583	32.73	42.00
IMC	24	37.42	0.203	0.996	2.661	35.92	39.42
IC	24	41.77	0.418	2.047	4.899	37.74	44.90

I.f.c.- corporal format index
I.m.- massiveness index
I.o.- skeleton index
I.c.- head index
I.v.s .- underbrisket vacuum index
I.m.c.- head size index
I.a.c. – rump sharpness index

Table 3
The values coefficients of heritability and repeatability of ours researches dairy cows

Characters specification	Additive variance	Intolot variance	Total variance	Heritability	Repeatability
Normal lactation lengh /days	10.4822	121.2462	110.7639	0.29	0.22
Milk /kg	147504.9400	133025.2920	280530.2330	0.33	0.30
Fat /%	0.0018	0.0041	0.0059	0.81	0.79
Fat /kg	226.0066	234.3872	460.3938	0.36	0.33
Protein /%	0.0030	0.0014	0.0044	0.77	0.68
Protein /kg	215.2156	179.2269	394.4426	0.34	0.27
Withers hight cm	2.4412	13.4462	11.0050	0.48	
Total lengt cm	26.3189	91.5679	65.2491	0.39	
Thoracic perimeter /cm	1.9633	77.1885	75.2252	0.41	
Corporal weight / kg	1822.7346	5946.8372	4124.1026	0.45	

The intensity of the relation can be considered low when the correlation coefficient has values bellow 0,2, medium for values between 0,2 and 0,5 and tight for values over 0,5.

The analyzing of the phenotypic, genetic and envirnonmental correlations between the length of the normal lactation and milk quantity, fat and protein showed positive values of 0,74 respectively 0,73, the charcters being tightly correlated and for the fat and protein percent the values were medium correlated (0,27, respectively 0,26). It has been shown from the research that the correlations between the length of the normal lactation and the external characters were negative and of low intensity.

The correlations between the milk quantity and the fat and protein percent were negative and for the quantity of fat and protein, tightly correlated and positive values were found.

Between the quantity of milk and the external characters the correlation was medium and positive. A medium correlation between the fat quantity and the protein percent was found and a tight and positive correlation between the first and the protein quantity (table 4).

CONCLUSIONS

1.The average values and the variability estimates for milk production features on successive lactations / normal lactation, expressed in EM showed a potential production of over 8000 kg milk/ cow (in average 8677,47 kg , with variation limits between 7.821,23-10.222,50 kg);

2.The main analyzed corporal indices registered average values of 139 cm (133-146cm) for wither hight, 140,75 cm (132-149 cm) for rump hight and 617,75 kg (520-819 kg) for corporal weight, the values being considered superior to the average of the breed;

3. The heritability and repeatability coefficients for qualitative production characters (fat and protein percents) had the following values: 0,81 and 0,77 respectively 0,79 and 0,68;

4. The phenotypic, genetic and environmental correlations between normal lactation length and the milk quantity, fat and protein were tightly correlated (0,73; 0,74 respectively 0,73), for the fat and protein percents the values were medium correlated (0,27 respectively 0,26) and for the external characters were negative;

5. The group of cows subject to our research registered an eumetric corporal growth correlated to the milk production type, characters emphasized by thin and compact constitution, wide head, long and deep trunk, and straight backline;

6. This morphological type has good abilities for milk production of over 8000 liters/ normal lactation, the genetic potential being much higher than the average level of BNR breed production.

REFERENCES

Books

[1] Negruţiu, E., Petre, A., Pipera, N.,: Genetica şi ameliorarea animalelor- Editura Didactică şi Pedagogică, Bucureşti, 1969

[2] Maciuc V.,: Managementul creşterii bovinelor, Editura Alfa Iaşi, 2006,

[3] Georgescu,Gh. şi col.,: Tratat de creşterea bovinelor., vol. I (1989), vol II (1988), vol III (1995), vol. IV (1998), Editura Ceres, Bucureşti,

[4] Grosu H., Pascal A. Oltenacu,: Programe de ameliorare genetica în zootehnie- Editura Ceres, Bucureşti, 20

Table 4
The values of phenotypic, genetic and environmental correlations coefficients of ours researches dairy cows

The first character	The second character	Phenotypic correlations	Genotipic correlations	Environmental correlations	Overall covariance	Intralot covariance	Total covariance
Normal lactation length	Milk - kg	0.73	0.88	0.66	1846.8472	2409.7385	4256.5857
	Fat - %	0.27	0.26	0.25	0.2555	0.1859	-0.0696
	Fat - kg	0.74	0.83	0.70	63.2145	110.8615	174.0761
	Protein-%	0.26	0.19	0.31	0.0206	0.3016	0.2811
	Protein- kg	0.73	0.82	0.70	61.1269	99.0538	160.1808
	Calving interval	0.22	0.25	0.27	71.7985	369.6154	441.4139
	Dry period	0.14	0.18	0.29	26.9476	45.5538	18.6063
	Withers hight	-0.10	-0.17	-0.16	-6.7735	3.3385	-3.4350
	Total length	-0.17	-0.11	-0.17	-8.8075	-7.3154	-16.1228
	Thoracic perimeter	-0.15	-0.18	-0.16	-40.9861	338692	-7.1169
	Corporal weight	-0.11	-0.12	-0.14	-224.5641	267.6231	-43.0590
Milk Kg.	Fat - %	-0.25	-0.24	-0.22	-9.2707	-2.0334	-11.3040
	Fat - kg.	0.97	0.97	0.98	5699.0026	5365.9692	11064.9718
	Protein-%	-0.24	-0.25	-0.26	-0.6137	-6.5814	-13.7764
	Protein - kg.	0.97	0.96	0.99	5461.0906	4803.2000	10264.2906
	Calving interval	0.26	0.22	0.29	6942.1799	12246.6923	19188.8722
	Dry period	0.08	0.06	0.10	1850.1987	2513.3538	663.1551
	Withers height	0.37	0.35	0.33	322.2492	59.1692	263.0800
	Total length	0.24	0.25	0.28	1274.3545	1266.3231	8.0314
	Thoracic perimeter	0.28	0.30	0.32	1699.6206	509.7231	1189.8975
	Corporal weight	0.46	0.44	0.48	7543.2514	3845.5231	3697.7283
Fat -Kg.	Protein-%	0.40	0.30	0.68	0.3294	0.2958	0.6252
	Protein- kg	0.96	0.94	0.99	215.5841	196.3231	411.9072
	Calving interval	0.25	0.17	0.69	156.3986	417.0000	573.3986
	Dry period	0.07	0.06	0.11	64.1481	87.6436	23.4955
Withers height	Total length	0.24	0.22	0.26	4.1818	1.9462	6.1279
	Thoracic perimeter	0.48	0.61	0.39	2.4563	10.9308	13.3871
	Corporal weight	0.46	0.53	0.42	0.5451	94.1692	93.6242
Total lengh	Thoracic perimeter	0.35	0.44	0.28	1.8282	26.1038	24.2756
	Corporal weight	0.43	0.65	0.27	100.9973	318.8295	217.8322
Thoracic perimeter	Corporal weight	0.93	0.93	0.94	140.5283	654.2423	513.7140