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ORIGINAL PAPER

Reproduction indexes of Grey Steppe cattle breed from Romania been in genetic bio preservation

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Abstract

Our purpose was to investigate the number of grey steppe cattle's present state in Romania and the possibilities of applying some modern biotechnologies in order to preserve this highly national and international important breed. The milk production's parameters underline that the average value of milk, on all lactations, was 1881 kg with 4.41% fat and 3.56% proteins and at EM (Maturity equivalent) 2224 kg of milk, with 4.36% fat and 3.52% proteins. Also, at a rational maintenance and sustenance, the grey breed of prairie cows' fecundity was 86.8% and the birth rate was 63.0% from the total number and 72.6% from the fertilized cows. From all the information above we learn that the number of grey steppe cows subject to genetic preservation cannot be selected in a direction that will ensure economic effectiveness. Thus, it is necessary for the government to provide for the preservation of this breed, which is currently being done. The grey steppe breed's genetic preservation and improvement program uses up to date techniques regarding: genetic and molecular markers, sperm preservation, super-ovulation and egg cells preservation. An important part is the storage of semen by freezing at very low temperatures and the possibility on long term utilization. Through this process, a gene fund from the best bull found in the population meant for preservation can be created and kept in a national gene bank for undetermined period.

Key words: breed, cattle, preservation genetics, biotechnology, super ovulation

Introduction

The grey steppe breed, found on all Romanian territory and under the strong influence of the natural environment, acquired remarkable features such as: rusticity, organic resistance, health, humility and roughness to environment conditions, which were imprinted in the hereditary basis and were transmitted through generations nowadays. The milk and meat production development has remained humble due to the strong influence of the harsh environment in the peasant establishments where they have been selected and grown (E.E. WILDMAN & al. [2], V. MACIUC & al. [8]).

Throughout time, the grey steppe Romanian breed faced a long crossbreeding process with the improved breeds such as: Simmental, Schwyz, Pizgau, Friesian resulting the ameliorated breeds Romanian Spotted, Brown of Maramureş, Romanian Black Spotted, Transylvania Pizgau.

Now, the breeds' extent area in Romania has disappeared, but isolated individuals were maintained in peasant households in Moldova and Danube Delta, and 62 individuals are kept at Dancu farm from S.C.D.C.B.-Dancu Iaşi and at SC TCE 3 Brazi SRL Neamţ.

Based on these facts our team has proposed preserving the genetic fund of Grey Steppe breed from Romania whose completion would materialize through a genetic resource management and integration of this breed in the actions of the international framework

program under the auspices of FAO, preservation of animal genetic resources (D. DUCLOS & al. [1], Y., DE HAAS & al. [12]).

For the grey steppe breed's preservation and improvement program modern techniques and biotechnologies will be used: semen preservation, super-ovulation and egg cells conservation.

Our purpose was to see the grey Romanian steppe breed samples' actual state and consider the possibility of applying modern biotechnologies for this important breed's preservation. This is very important now that researchers approach the genetic biodiversity problem and wish to increase and protect the old breeds' genetic fund, actions coordinated by FAO.

Material and methods

The investigations were carried out on a number of 35 grey steppe breed cows from Development Research Station for Cattle Growing Dancu, Iaşi (S.C.D.C.B. Dancu Iaşi). Several aspects were analysed on these cows such as: milk production parameters throughout official production register and correlation of production at Maturity equivalent after lactation period, sample's body development, reproduction's main parameters (age at first calving and calving season and in calculation of the age of first calving, we took the animal date of birth until the date of first calving; calving interval which is synthetic index that highlights best breeding activity and it was calculated by summing the period of gestation with service period, service period was from parturition date until the fertile insemination date; and mamary repause represents the intreval from weaning until the next parturation) health condition and possibility of grey steppe Romanian breed cattle's genetic preservation. The data came from observations and direct determinations on each animal in the farm, on the field, from the farm's data bank and OARZ Iaşi (Office for Breeding and Reproduction in Animal Husbandry Iaşi).

All the data was statistically processed: the arithmetic mean (X), the average error ($\pm s_{\bar{x}}$), standard deviation (s), variability factor (V%) integrated in tables and diagrams. The statistics was analysed using the SPSS 16.00 program for Windows (N.R. ZWALD & al. [6], V. MACIUC & al. [9]).

Results

The milk production and the grey steppe breed cows' reproduction parameters overseen by the Official Control of Production (COP) are presented in table 1. The average milk production at all lactations was 1881 kg with 4.41% fat and 3.56% proteins and for EM (Maturity Equivalent) was 2224 kg with 4.36% fat and 3.52% proteins.

Table 1. Milk production and grey steppe breed reproduction parameters on successive lactations.

Lactation	No. lactations	Milk (kg)	Fat		Proteins		VP		CI days
			kg	%	kg	%	months	days	
1	3	1315	61	4.67	48	3.66	28	0	
2	3	2476	112	4.53	92	3.74			426
3	4	2103	85	4.12	69	3.36			526
4	1	902	40	4.42	32	3.56			428
All	11	1881	82	4.41	66	3.56			483
All (EM)	11	2224	96	4.36	78	3.52			

The number of lactations and the milk production average on standard lactations, in EM, between years 2001-2008 are presented in table 2. There is a minimum production of 1660 kg in 2003 and a maximum production in 2002: 3192 kg with 3.91% fat and 3.47% protein, and fat plus protein 236 kg (V. MACIUC & al. [9]).

Table 2. Number of lactations and milk production average on standard lactations, in EM, between 2001-2008.

Year	Number of lactations	Milk (kg)	Fat		Proteins		F+P (kg)
			Kg	%	kg	%	
2001	5	2592	97	3.81	92	3.32	198
2002	1	3192	125	3.91	111	3.47	236
2003	4	1660	71	4.27	56	3.35	127
2004	14	2282	97	4.26	73	3.21	140
2005	16	2155	99	4.62	75	3.50	174
2006	17	2434	119	4.93	88	3.61	207
2007	17	1949	86	4.52	70	3.63	156
2008	11	2224	96	4.36	78	3.52	174

The researches made on our cows found in genetic preservation at Development Research Station for Cattle Growing Dancu, Iaşi (S.C.D.C.B. Dancu Iaşi) proved that the total lactation's duration is also the normal lactation duration since the lactation time of 305 days (254.80-290.50 days) was not broken. The period of gestation took place between 275 and 282 days with a standard error between 2.88-10.06 days. The quantity of milk on the lactation ranged between 1589.64 kg (1^{st} lactation) and 2535.43 kg on the lactation which is also the maximum lactation. Starting with the 6^{th} lactation, the milk quantity starts to descend so that in the 8^{th} lactation it reaches 1078.5 kg.

The first lactation was 62.69% from the maximum lactation. This value highlights the tardiness regarding the milk production of the grey steppe breed.

Regarding the milk quality, the fat percent reaches its maximum value of 4.71% in the 5^{th} lactation. The protein percent has the same evolution and in the 5^{th} lactation reaches the maximum value of 3.71%. Variability in the indicators mentioned is intermediate to high (V = 6.09 to 12.06%), which offers a wide field of population improvement by selection for milk yield qualitative indicators

The studied cows had the average body of 122.28 cm and weighed 542.86 kg. There were also exceptions that weighted 710.00 kg.

The analysed group of cows were roughly the same size, thus the variability of the size is not underlined (s=3.06, V%=2.51).However, the weight presents a great variability with dispersion parameters s=99.38 and V%=18.30.

The reproduction parameters analysis shows (table 3) an average age for the first birth of 39.03 months, with limits between 22 and 58 months, which proves a weak reproduction

character for the grey steppe breed (V. MACIUC & al. [10], O. GONZALEZ-REICO & al. [4], V. PANTELIĆ & al. [11]).

Table 3. Reproduction parameters for the grey steppe breed nucleus

Specifications	n	$\overline{X} \pm s_{\bar{x}}$	s	V%	Min.	Max.
Age at first calving (VP)-months	19	39.03±23.79	10.36	26.54	22	58
Gestation period (DG1-days 1st lactation)	18	280.78±13.90	5.89	2.10	269	293
Gestation period (DG_2-days 2nd lactation)	11	280.09±17.50	5.80	2.07	268	287
Service-period (SP_2-days)	10	255.30±58.75	35.79	72.77	32	541
Gap between calvings (CI_2-days)	10	506.60±56.77	49.53	35.43	300	826
Gestation period (DG3 days 3rd lactation)	9	279.00±3.712	21.13	3.99	255	290
Service-period (SP3 days)	9	262.44±42.78	38.36	48.91	61	418
Gap between calvings (CI3 days)	9	541.44±41.70	55.09	23.10	351	701
Gestation period (DG_4- days 4th lactation)	3	26I.67±16.34	28.30	10.81	229	279
Service-period (SP_4-days)	3	139.33±48.88	44.67	60.76	42	196
Gap between calvings (CI_4-days)	3	401.00±65.12	52.80	28.13	271	273

The gestation time had the value of 280 days, which is shorter than the time needed by the milk and mixed breeds, the maximum value reaching 293 days.

The service-period and the calving time registered average value was far above the normal, which means that the reproduction did not occur in normal parameters due to some precarious management conditions (V. MACIUC & al. [10], O. RAVAGNOLO & al. [5]).

A research regarding the Popăuţi-Botoşani cows' reproduction activity, made between 1926-1940 shows that for a rational nutrition and maintenance the reproduction was 86.8%, the birth rate was 63.0% in relation to the total number of cows and 72.6% in relation with the fertilized ones (table 4, GH. DINCĂ & al. [3]).

Table 4. Grey steppe breed cows from Moldova's fertilization and birth rate

Years	Number of cows	No. of reproduction cows	Fertilized cows		Born cows			No. of cows with double calvings	No. of cows with dead after-birth calves	Nr. of cows reformed or other causes
			N	% of reproduction cows	N	% of reproduction cows	% of fertilized cows			
1926	63	55	51	92.7	38	69.9	74.5	-	-	10
1928	64	55	47	85.0	36	65.4	76.5	2	1	16
1930	58	45	41	91.1	29	64.4	70.7	1	1	1
1932	64	44	31	70.1	22	50.0	70.9	-	-	14
1934	67	55	49	89.0	21	38.1	42.8	2	1	18
1936	60	55	50	90.9	39	70.9	78.0	4	6	6
1938	75	70	66	94.2	46	63.7	69.6	1	5	9
1940	82	67	52	77.6	50	74.6	96.1	3	10	20
Total	533	446	387	86.8	281	63.0	72.6	13	24	94

Calving occurs in a normal way, except the rare hard cases with dystocia, placenta retention and other genital after-birth problems. Cows have a very developed maternal instinct and cannot be milked without their calf. The heifers can be fertilized at 2-2.5 years and at 3.5 in regard to their first calf.

From all the information above we can conclude that the grey steppe breed cattle subject to genetic preservation cannot be selected in a direction which would ensure its economic efficiency. Thereafter it is necessary for the government to fund the breed preservation project, action which is done at present. Given the current economic situation, the funded breed maintenance implies an agreement from the entire society, because it serves the interests of a remote future and of a cultural legacy.

In the genetic preservation and improvement of the grey steppe breed program several modern techniques can be used: genetic and molecular makers, semen preservation, super-ovulation and egg cells preservation. An important part is the storage of semen by freezing at very low temperatures and the possibility on long term utilization. Through this process, a gene fund from the best bull found in the population meant for preservation can be created and kept in a national gene bank for undetermined period (ŞT. CREANGĂ & al. [7]).

The current semen preservation techniques can also be used for egg cells preservation or the embryos from the selected cows in the population subject to genetic preservation.

Super-ovulation is a practiced technique in the cattle improvement programs and has the advantage of the egg cells or embryos preservation and genetic resources evaluation through the selected female descendents number multiplication by 20-30 or more.

The seminal fluids preservation technique combined with egg cells or embryos storage and with the simple transplant techniques is a less expensive grey steppe breeds' genetic preservation and improvement.

"In vitro" insemination and the as-they-are or divided fertilized egg cells utilisation have the same advantages for the artificial insemination in the near to extinction grey steppe breed preservation.

Nowadays we can speak about egg cells and embryos "banks" which are presented to those interested through an international trading process. This pattern can also be applied for the grey steppe breed if the Excellency Centre from Dancu Station Iaşi, helped by European funds, is included.

The grey steppe breed genetic preservation in the cattle improvement is an important current problem with large implications in general international husbandry. Specialists say that in the future the individuals carrying the resistance should be used in the genetic improvement process and, especially, creating hybrids more resistant to environmental conditions. The disease endurance depends on this particular gene as well as the endurance to the diversity of ecological factors. This is the reason why the grey steppe breed should also be used in the cattle improvement process, beside the breeds with a higher degree of reproduction.

The principal technical parameters in the grey steppe breed genetic preservation process are presented in table 5. Among the measures designed for the Romanian grey steppe breed genetic fund preservation, a gene bank ("gene pool") was developed. It is designed for the gene's long-term storage, for they will be good to use in the future. Theoretically, these genes can be stored in genetic preservation as an entire population, be it as isolated individuals (in zoological gardens) or even as gametes; for example sperm or frozen egg cells, as it was already shown.

Table 5. Main technical parameters of genetic preservation and improvement frame program for Grey Steppe breed

Specification	U.M.	Technical parameters
1. Selection goals: a. Rate of characters in global improvement value:		
- milk	%	45
- meat	%	45
- fitness	%	10
b) average production on a normal lactation (at EM):		
- milk	kg	3000
- fat	%	4,75
	kg	142,5
- proteins	%	3,50
	kg	105,0
c) Weight	kg	550
d) Height for:		
- withers	cm	124
- rump	cm	126
2. Cows in Official control (COP)	head	100

3. Artificially inseminated cows and heifers (IA1)	head	75
	%	75
4. Total necessary m.s.c. (2 shots/IA1/gestation)	dose	140
5.Bulls in exploitation, from which:	head	4
- to artificial insemination	head	1
- to natural insemination	head	3
6. Annual replacing rate (3 years average time of exploitation)	%	33.3

In the current state of the grey steppe breed it is wise only to preserve the animals, than is the number of cows at Dancu farm and S.C.T.C.E. 3 Brazi Neamț, where the reproduction is natural. To prevent great gene losses through random movement of their frequency by drift, there should be a population of at least 100 individuals. This centre must be financed with a special fund being that it does not bring a direct income, but has a great moral and positive material influence, because without a preservation form the animal world would become poorer.

In the genetic preservation and improvement of the grey steppe breed program several modern techniques can be used: genetic and molecular makers, semen preservation, super-ovulation and egg cells preservation. An important part is the storage of semen by freezing at very low temperatures and the possibility on long term utilization. Through this process, a gene fund from the best bull found in the population meant for preservation can be created and kept in a national gene bank for undetermined period.

This centre must be financed with a special fund being that it does not bring a direct income, but has a great moral and positive material influence, because without a preservation form the animal world would become poorer.

Conclusions

The milk production analysis highlights that the average milk value, on all lactations, was 1881 kg with 4.41% fat and 3.56% proteins and at E.M. was 2224 kg with 4.36% fat and 3.52% proteins. Moreover, for a rational grey steppe breed nutrition and maintenance the fertilization was 86.8% and the birth rate was 63.0% in relation to the total number and 72.6% in relation to the inseminated cows.

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