

COMPARATIVE STUDY REGARDING THE PHENOTYPIC PERFORMANCES OF THE ASCENDANCE AND DESCENDANCE OF DAIRY CATTLE FROM HUSBANDRY HOLDINGS IN NEAMȚ COUNTY

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Abstract

In this study, the productive performances of the descendants and descendants of the cows' herd belonging to the 4 basic breeds were analyzed, as follows: Holstein, Bălțată cu negru românească (Romanian Black Spotted), Bălțată românească (Romanian Spotted), and Brună de Maramureș (Maramures Bown), from 7 farms of Neamț county, which were encoded with numbers from 1 to 7. For the analysis of the descendants' performances - mother (M), paternal grandmother (MT), and maternal grandmother (MM) - and of the offspring' performance, 3 indicators were determined regarding the milk production: the quantity per normal lactation (kg), the percent of fat, and the percent of protein. It was found that the best milk production in normal lactation of offspring was recorded in farm 2 (6161.25 kg), where a mixed herd of Holstein and Bălțată cu negru românească breeds is raised. If we compare the phenotypic performances of the descendants (mother of mother - MM), which realized an average milk production of 7205.44 kg, with the father's mother (MT) of 11.931 kg, and the mother's mother (MM) of 7949.83 kg we confirm that the phenotypic performance for the milk production in the offspring does not reach the level of those obtained by ancestry. This fact is due to management deficiency regarding the external factors.

Key words: ancestors, cattle, descendants, milk, production.

INTRODUCTION

In cows, individual milk production is influenced by a number of factors which, according to nature, can be grouped as follows: genetic and physiological factors and environmental factors (Velea et.al., 2004).

The category of genetic factors includes factors directly related to the hereditary and physiological basis of cattle and influences the productive potential of their populations or individuals (Gilcă et al., 2006).

In order to improve the genetic base of cattle in Neamț County, in late years, imports of live breeding animals and frozen semen from high biological value bulls have been made.

In the studied area there is a tendency to increase mixed breeds (milk-meat) as well as those specialized in milk production, with high productive potential.

Environmental factors that influence the phenotypic performance of cattle relate particularly to the technology of exploitation, feeding and production having a decisive role.

The operating technologies used may lead to different production and economic outcomes, generated in particular by the maintenance and operation system, the calf growth, the production and use of fodder, the use of constructions, installations and machinery, the production and work management. (Stoica et al., 2002)

Nutrition plays a key role in milk production and other environmental factors, in fact changing the degree of conversion of food to milk.

The planning of the breeding process has a decisive role in the growth and exploitation of cattle. This directly influences the herd increase, the improvement of the quality, the increase of the milk production and of the economic efficiency (Dinescu & Tontsch, 2002).

The objectives pursued in the breeding process are to achieve throughout the year an optimal structure of the herd, by physiological states and to obtain the highest fertility, the task being to obtain from each cow, each year, one calf characterized through high viability (Onaciu, 2006).

MATERIALS AND METHODS

In order to assess the main indicators that characterize the phenotypic performances of the cattle breeds with mixed milk-meat skills and those specialized for milk raised and exploited in Neamț county, a total number of 856 cows was studied. The studied reproduction herd was of 447 cattle, consisting of: 103 heads of the Brună de Maramureș (Maramures Brown) breed, 50 heads of the Băltătă românească (Romanian Spotted) breed, 188 heads of the Băltătă cu negru românească (Romanian Black Spotted) breed, and 106 heads of the Holstein breed.

Statistical processing of milk production in the bovine herd studied has been carried out for 3 characteristics of milk production: normal milk lactation (kg), fat content (%) and protein proportion (%).

The data analysis was performed by calculating the parameters, which characterize a normal distribution, on the one hand the mean or average (\bar{X}), and on the other hand the dispersion indices represented by standard deviation (s), arithmetic mean error ($\pm s_{\bar{x}}$), coefficient of variability (V%).

The seven farms studied were coded from 1 to 7 and are shown in Table 1.

Table 1. Diary cattle farms encode

Farm encode	Name of the farm	Breed
1	I.F. Anghel Oana Brândusa	Băltătă cu negru românească
2	P.F.A. Muraru Constantin Felix	Holstein; Băltătă cu negru românească
3	Nacu Gheorghe	Holstein; Băltătă cu negru românească
4	P.F.A. Olariu Neculai Marius	Brună de Maramureș
5	SCDA Secuieni	Brună de Maramureș
6	I.I. Ciucalau Aurelia Vasilica	Băltătă românească
7	P.F.A. Pintea Ionela	Băltătă românească

RESULTS AND DISCUSSIONS

Table 2 shows the data on the average values and variability of the milk production indices of the ascendants for farm 1 which shows that in the case of the mother the quantity of milk averaged 6537.03 kg, while for the father's mother it was higher of 10370.07 kg, and for the mother's mother of 6511.36 kg. Thus, if we take into

account the production performances written in the literature for the Băltătă cu negru românească breed, where the standard of milk production is 5000-5700 kg, the milk fat content is 3.8-3.9%, and the protein content is 3.22% (Maciuc et.al., 2015), it can be said that farm 1 has a valuable ascendance.

Table 2. Average values and variability of milk production in farm 1

Upward	Characters	n	\bar{X}	$\pm s_{\bar{x}}$	s	V%	Minimum	Maximum
M.	Milk kg	29	6537.03	222.847	1200.070	18.358	3776.00	9234.00
	Fat %	29	3.33	0.055	0.294	8.824	2.61	3.99
	Protein %	29	3.28	0.025	0.134	4.100	2.99	3.54
MF.	Milk kg	15	10370.07	391.752	1517.250	14.631	7757.00	11551.00
	Fat %	15	4.08	0.113	0.436	10.697	3.49	4.40
	Protein %	0	0.00	0.000	0.000	0.000	0.00	0.00
M.	Milk kg	14	6511.36	387.241	1448.923	22.252	2915.00	8595.00
	Fat %	14	3.16	0.142	0.533	16.859	2.40	4.12
	Protein %	14	3.23	0.048	0.179	5.546	3.03	3.78

Legend: M-mother; MF-mother of the father; MM- mother of the mother.

Table 3 shows the data on the average values and variability of the milk production indices of the ascendancy for farm 2. It was found that the average production on normal lactation of mothers is 7205.44 kg, in paternal grandmothers 8160.67 kg, and in maternal grandmothers 7949.83kg.

From the analysis of the dispersion degree, the standard deviation having the maximum value of $s = 1456.494$ kg milk, and the maximum coefficient of variation of $V\% = 20.214$ in mothers, in paternal grandmothers $s = 0$ kg of milk, as well as the coefficient of variation $V\% = 0$ kg, but it is necessary to specify that data were found only for two animals that achieved

the same performance on the average value of milk production on normal lactation, and in maternal grandmothers $s = 690.986$ kg, the maximum coefficient of variation of $V\% = 8.692$, it can be said that there is an average homogeneity regarding the phenotypic performances registered by mothers and maternal grandmothers, the farmer has the possibility to select the most valuable animals for use in multiplication.

Table 3. Average values and variability of milk production indices of farm 2

	Upward	n	\bar{X}	$\pm s \bar{x}$	s	V%	Minimum	Maximum
M.		16	7205.44	364.124	1456.494	20.214	5014.00	10439.00
		16	3.94	0.068	0.272	6.890	3.55	4.44
		16	3.29	0.054	0.214	6.520	2.98	3.75
MF.		2	11.931	0.000	0.000	0.000	11.931	11931.00
		2	3.94	0.000	0.000	0.000	3.94	3.94
MM.		0	0.00	0.000	0.000	0.000	0.00	0.00
		6	7949.83	282.094	690.986	8.692	6566.00	8345.00
MM.	Fat %	Milk kg	Protein %	Fat %	Milk kg			
	Fat %	6	4.07	0.157	0.385	9.458	3.67	4.65
MM.	Fat %	6	3.39	0.109	0.268	7.907	3.01	3.65

Legend: M-mother; MF-mother of the father; MM- mother of the mother.

Table 4 presents the data on the average values and variability of the milk production indices of the ascendancy for farm 3 which shows that for the quantity of milk for mother had an average of 6801.41 kg, and for paternal grandparents they recorded an outstanding performance of 13352.87 kg, and to the maternal grandmothers 7015.00 kg.

From the analysis of the degree of dispersion, the standard deviation having the maximum value of $s = 1716.487$ kg of milk, and the maximum coefficient of variation of $V\% =$

25.237 in mothers, in paternal grandmothers $s = 3452.779$ kg of milk, the coefficient of variation $V\% = 25.858$ kg, and in maternal grandmothers $s = 1397$ kg, the maximum coefficient of variation of $V\% = 19.928$, it can be said that there is a heterogeneous population regarding the phenotypic performances registered by mothers and maternal grandmothers, and in maternal grandmothers an average homogeneity is observed (this requires special attention from the farmer in the selection and mating management, because only on the basis of knowledge of performance - amount of milk, percentage of fat, percentage of protein - the parents of the next generation are chosen (Păcală, 2000).

Table 4. Average values and variability of milk production indices of farm 3

	Upward	n	\bar{X}	$\pm s \bar{x}$	s	V%	Minimum	Maximum
M.		27	6801.41	330.338	1716.487	25.237	3473.00	12786.00
		27	3.84	0.079	0.409	10.645	2.69	4.65
		27	3.39	0.042	0.220	6.502	2.53	3.65
MF.		15	13352.87	891.504	3452.779	25.858	6649.00	16987.00
		15	4.00	0.111	0.428	10.706	3.30	4.37
MM.		2	3.19	0.085	0.120	3.774	3.10	3.27
		8	7015.00	494.247	1397.941	19.928	4368.00	8577.00
MM.	Fat %	Milk kg	Protein %	Fat %	Milk kg	Protein %	Fat %	Milk kg
	Fat %	8	3.89	0.114	0.322	8.285	3.45	4.36
MM.	Fat %	8	3.17	0.125	0.355	11.194	2.53	3.65

Legend: M-mother; MF-mother of the father; MM- mother of the mother.

Table 5 shows the data on the average values and variability of the milk production indices of the ascendancy for the farm 4 from which it is observed that for mother, the quantity of milk averaged 5413.89 kg, for the paternal grandmothers the productive performances are not registered in the database, and for the mother's mother of 5475.00 kg.

Table 5. Average values and variability of milk production indices of farm 4

		Upward						
		n	\bar{X}	$\pm s \bar{x}$	s	V%	Minimum	Maximum
			Milk kg	Fat %	Protein %			
M.	9	5413.89	92.372	277.117	5.119	5035.00	5857.00	
	9	3.54	0.168	0.504	14.240	2.40	3.98	
	9	3.49	0.026	0.150	4.289	3.21	3.91	
MF.	0	0.00	0.000	0.000	0.000	0.00	0.00	
	0	0.00	0.000	0.000	0.000	0.00	0.00	
	0	0.00	0.000	0.000	0.000	0.00	0.00	
MM.	3	5475.00	206.730	358.067	6.540	5147.00	5857.00	
	3	3.33	0.476	0.825	24.791	2.40	3.98	
	3	3.58	0.057	0.170	4.765	3.27	3.92	

Legend: M-mother; MF-mother of the father; MM- mother of the mother.

Table 6 shows the data on the average values and variability of the milk production indices of the ancestry for farm 5 which shows that in the case of the mother the quantity of milk had an average of 6258.38 kg, for the paternal grandmothers the productive performances are not recorded in the database, and to the mother's mother of 6471.00 kg.

Table 6. Average values and variability of milk production indices of farm 5

		Upward						
		n	\bar{X}	$\pm s \bar{x}$	s	V%	Minimum	Maximum
			Milk kg	Fat %	Protein %			
M.	34	6258.38	122.933	716.816	11.454	5308.00	8286.00	
	34	3.99	0.046	0.271	6.773	3.56	4.63	
	33	3.61	0.047	0.140	3.873	3.36	3.78	
MF.	0	0.00	0.000	0.000	0.000	0.00	0.00	
	0	0.00	0.000	0.000	0.000	0.00	0.00	
	0	0.00	0.000	0.000	0.000	0.00	0.00	
MM.	9	6471.00	178.614	535.843	8.281	5704.00	6993.00	
	9	4.28	0.139	0.416	9.700	3.57	5.01	
	9	3.70	0.052	0.091	2.455	3.60	3.78	

Legend: M-mother; MF-mother of the father; MM- mother of the mother.

Table 7 presents the data on the average values and variability of the milk production indices of the ascendancy for the farm.

From the analysis of the dispersion degree, the standard deviation having the maximum value of $s = 989,237$ kg of milk, and the maximum coefficient of variation of $V\% = 13,713$ for maternal grandmothers, for paternal grandmothers $s = 1303,974$ kg of milk, the maximum coefficient of variation of $V\% = 11,734\%$, in the paternal grandmothers, and in the maternal grandmothers $s = 487,046$ kg, the maximum coefficient of variation of $V\% = 6,525\%$, a particularly favorable situation is revealed for the selection in order to improve the productive performances in the offspring.

Table 7. Average values and variability of milk production indices of farm 6

		Upward						
		n	\bar{X}	$\pm s \bar{x}$	s	V%	Minimum	Maximum
			Milk kg	Fat %	Protein %			
M.	11	7214.09	298.266	989.237	13.713	6154.00	9705.00	
	11	3.99	0.069	0.227	5.690	3.51	4.31	
	11	3.46	0.073	0.244	7.047	3.13	3.92	
MF.	11	11113.00	393.163	1303.974	11.734	9362.00	13391.00	
	11	4.14	0.056	0.184	4.450	3.92	4.35	
	11	3.55	0.070	0.231	6.508	3.26	3.95	
MM.	8	7464.88	172.197	487.046	6.525	6929.00	8139.00	
	8	3.87	0.116	0.327	8.453	3.48	4.48	
	8	3.32	0.052	0.147	4.418	3.13	3.48	

Legend: M-mother; MF-mother of the father; MM- mother of the mother.

Table 8 shows the data on the average values and variability of the milk production indices of the ancestry for farm 7, which shows that in the case of the mother the quantity of milk averaged 5119.86 kg, while in the case of grandparents higher values were recorded of 10627.00 kg, but it is specified that we have the production performance for a single animal and cannot be representative for the entire population of cows with reference to the performance of paternal

grandparents, as well as maternal grandmothers productive performance is from a single animal, respectively of 5340.00 kg.

Table 8. Average values and variability of milk production indices of farm 7

Upward	Characters	n	\bar{X}	$\pm s \bar{x}$	s	V%	Minimum	Maximum
M.	Milk kg	7	5119.86	77.910	206.131	4.026	4945.00	5340.00
	Fat %	7	3.06	0.182	0.483	15.771	2.34	3.59
	Protein %	7	3.29	0.019	0.049	1.503	3.20	3.37
MF.	Milk kg	1	10627.00	0.000	0.000	0.000	10627.00	10627.00
	Fat %	1	4.34	0.000	0.000	0.000	4.34	4.34
	Protein %	1	3.36	0.000	0.000	0.000	3.36	3.36
MM.	Milk kg	1	5340.00	0.000	0.000	0.000	5340.00	5340.00
	Fat %	1	2.82	0.000	0.000	0.000	2.82	2.82
	Protein %	1	3.29	0.000	0.000	0.000	3.29	3.29

Legend: M-mother; MF-mother of the father; MM- mother of the mother.

Summarizing the data presented in all the tables, it can be stated that the limit of variation of the productive performances of the mothers was between 5119.96 kg in patient 7 and 7214.09 kg in patient 6.

One aspect that determines the difference between the productive performances is the one related to the forage conditions in all the farms. Regarding this important link of the technological flow from dairy cattle farms, it is known that the productive genetic potential of each individual can be highlighted especially by administering balanced rations regarding the quantity and also the quality (Velea et.al., 2004). The paternal grandmothers from farm 3 are the most valuable, the average milk production per standard lactation was 13352.87 kg values obtained through testing after offspring) (Creangă et.al., 2008).

It should be noted that on farm 7, the productive performance for the parental grandparents (MT) cannot be taken into account, being recorded one single animal.

For farms 4 and 5 where the Brună de Maramureş breed is raised, the productive performances for the paternal grandparents are not registered.

Regarding the productive performances achieved by the maternal grandparents (MM) from the seven farms studied, it can be said that the maternal grandmothers (MM) from farm 2 achieved an average milk production of the best lactation, which is 7949.83 kg.

Regarding the ascending performance of the level of milk fat percentage in all the studied farms, it can be stated that the milk of the paternal grandparents (MT) from farm 6 has the highest fat percentage, of 4.14%, although farm 7 shows the highest fat percentage, at 4.34%, only animal and we cannot calculate this value as a representative for this farm.

The analysis of the percentage of milk fat in maternal grandparents (MM) shows the superiority of those on farm 5, which recorded a very good fat percentage of 4.28.

Regarding the protein content of milk from the data presented, the best performance was shown in mothers and maternal grandparents on the farm 5. In mothers, the proportion of milk protein was 3.61% and in maternal grandparents 3.70%. Thus, the milk from the Brună de Maramureş cows is suitable for the cheese industry, the yield being about 16% higher compared to other breeds (Acatincăi, 2004).

From the data presented in figure 1 regarding the performance of milk production from the seven farms studied, in the offspring, at the first two lactations, the following are revealed:

At farm 1, the average milk production per total lactation in the 1st one was 6883.45 kg and 5413.82 kg per normal lactation; it was observed that in the second one it decreases registering 6031.80 kg per total lactation and 5394.20 kg per normal lactation.

At farm 2, for the first lactation, the average value of milk per total lactation was 6733.25 kg, in the normal lactation was 6161.25 kg, and at the second lactation there was an increase observed, both in the average milk production per total lactation, which was 7737.45 kg, as well as the production obtained on normal lactation, achieving 6938.09 kg of milk (this represents an increase of 776.84 kg).

At farm 3, in the first lactation, the average value of the total quantity of milk per lactation was

6753.29 kg, at the normal lactation of 6041.68 kg, and at the second lactation there is a decrease, both in the average milk production per total lactation, which was 6448.11 kg, as well as the production obtained on normal lactation, achieving 5430.68 kg of milk.

At farm 4, at the second lactation, the average value of the total amount of milk per lactation was 6025.00 kg, at normal lactation 4673.00 kg, and at the second lactation there is a decrease, both in the average milk production per total lactation, which was 4615.00 kg, as well as the production obtained on normal lactation, achieving 4497.00 kg of milk.

In farm 5 the average production on total lactation I is higher, respectively 7428.18 kg, compared to that obtained on total lactation II, this being 6892.11 kg. This is due to the higher number of lactation days, respectively 73.30. However, it can be seen that although the average milk production per total lactation at the second lactation decreased by 536.07 kg of milk, at normal lactation at the second lactation there is a slight increase in the average milk production of 50.82 kg, because at the second lactation an average production of 5683.26 kg of milk was registered, and at the second lactation 5734.08 kg.

At farm 6, at lactation, the average value of the total lactation was 7791.00 kg, the normal lactation was 5967.80 kg, and at lactation II there was a decrease, both in the average milk production and total lactation, which was 5901.56 kg, and of production obtained by normal lactation, reaching 5012.89 kg of milk.

At farm 7, the average value of the total lactation was 4702.00 kg at lactation, the normal lactation was 4420.67 kg, and at the second lactation there was an increase, both in the average milk production and the total lactation, which was 6074.00 kg, and of production obtained by normal lactation, reaching 5209.17 kg of milk.

In summary, it can be said that in the first two lactations, the milk production on normal lactation, in the studied farms, with the exception of farms 2, 5 and 7, at the second lactation there was a decrease in the average milk production on normal lactation, which it is mainly determined by the technological factors of operation and the poor management of these farms.

It is also found that productive performances have been achieved which can be appreciated as modest, compared to the productive performances recorded in ascendancy. (Figure 1)

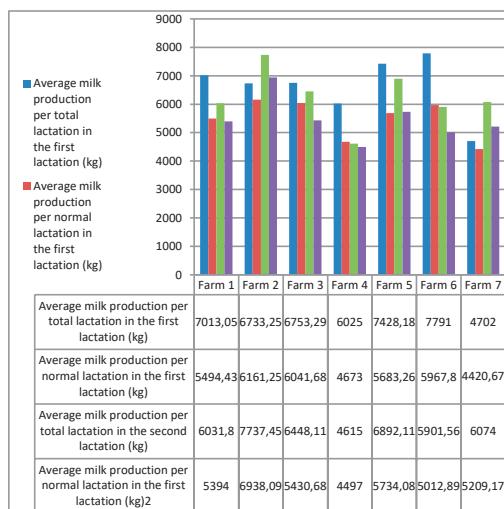


Figure 1. Average milk production, on total and normal lactation at the first offspring

CONCLUSIONS

The following conclusions can be drawn from the study:

The most valuable ancestry is owned by farmers: Nacu Gheorghe and I.I. Ciucălău Aurelia Vasilica, who have the highest average milk production on normal lactation in the studied animals.

In Nacu Gheorghe farm, the mothers achieved an average milk production on normal lactation of 6901.41 kg, the paternal grandmothers 13352.87 kg, and the maternal grandmothers 7015.00 kg. In this farm the Holstein breed and the Romanian Black Spotted breed are bred.

On the P.F.A. Muraru Constantin Felix, the mothers achieved an average milk production on normal lactation of 7205.44 kg, the paternal grandmothers of 8160.67 kg, and the maternal ones of 7949.83 kg. In this farm the Holstein breed and the Băltătă cu negru românească breed are raised.

On the I.I. Ciucălău Aurelia Vasilica, in mothers it was an average milk production on normal lactation of 7214.09 kg, in paternal grandmothers of 11113.00 kg and to maternal

grandmothers 7464.88 kg; the Bălțată românească breed is raised in this farm.

It should be noted that in the three farms where the ancestry is most valuable, it comes from imports, respectively from Ireland, on farms 2 and 3 for the Holstein breed and on farm 6 in Germany and for the German Spotted breed respectively (Fleckvieh).

There are significant differences between the yields obtained by farms 2, 3, and 6 compared to farms 1, 4, 5, 7.

From the analysis of the percentage of fat in milk obtained in the seven farms studied, the best results are revealed in farm 5 and farm 6. In the two farms, two breeds of cattle are raised, which are characterized morpho-productively by a mixed type, milk-meat, these being the Brună de Maramureș breed, on farm 5 and the Bălțată românească breed on farm 6, both being known for their high milk fat content.

The analysis of the quantitative indices of milk production at the first lactation on normal lactation for the seven farms studied showed that the best milk production on normal lactation was recorded on farm 2, as 6161.25 kg, followed by farm 3 with 6041 kg milk, 3rd place is occupied by farm 6 with 5967.80 kg of milk, which is justified by the valuable ancestry of the three farms.

At the same time, if we make a comparative analysis between the phenotypic performances in the offspring from farm 2, which has indeed the highest production, as 6161.25 kg of milk, with the phenotypic performances of that descendant, the mother's mother (MM), who achieved an average production of milk of 7205.44 kg, the father's mother (MT) of 8160 kg of milk, and the mother's mother (MM) of 7949.83 kg of milk.

The same happens for farm 3 where the production of milk on normal lactation is 6041.68 kg of milk, and where the ancestry is also valuable, the mothers recorded an average production of 6801.41 kg of milk, the maternal grandmothers 7015 kg, and to emphasize here the outstanding productive performance of the paternal grandparents who achieved 13352.87 kg of milk on normal lactation shows that the offspring fails to reach the phenotypic performance of the offspring.

Regarding this aspect of the difference in productive performance between offspring and

offspring, it can be concluded that the performances obtained in the offspring are lower than those from the descendant, on the one hand because the cattle exploited in these two farms are not acclimatized in this area of the county. German, and on the other hand, the best maintenance conditions were not ensured, and especially a good quality feed.

A comparative study was made regarding the production performances obtained at the 1st lactation with those from the 2nd lactation registered in the 7 farms studied, which show the following:

- on farm 2, at the second lactation the average value of milk per total lactation was 6733.25 kg, at normal lactation 6161.25 kg, and at the second lactation there is an increase, both in the average milk production per the total lactation, which was 7737.45 kg, as well as the production obtained on normal lactation, achieving 6938.09 kg of milk, which represents an increase of 776.8 kg;

- in farm 5 the average production on total lactation I is higher, as 7428.18 kg, compared to that obtained on total lactation II, this being 6705.42 kg, but this is due to the higher number by 84.52 days of the total lactation duration. However, it can be seen that although the average milk production per total lactation at the second lactation decreased by 722.76 kg of milk, at normal lactation at the second lactation there is a slight increase in the average milk production of 16 kg;

- in all other farms (farms 1, 3, 4, 6, and 7), there is a downward evolution of the average milk production at the second lactation compared to the 1st lactation, which reveals the need to improve the management of the factors influencing the productive performances in dairy cattle.

REFERENCES

- Acatincăi, S. (2004). Cattle production. 2nd Edition, Timișoara, RO: Eurobit Publishing House.
- Alexiou, A., & Roșca, L. (1987). *Practical guide for the selection and management of cattle breeding pairs*. Bucharest, RO: Ceres Publishing House.
- Bordeianu, R. (2003). *Milk hygiene*, Bucharest, RO: ANCA.
- Creangă, Ș., Maciuc, V., & Pîntea, M. (2008). Genetic polymorphism in cattle breeding in the Moldova area. *Scientific papers Animal Husbandry Series*, 42 (2).

- Crișan, G., Onaciu, G. & Crișan, D. (2012). Research on the morphological and productive properties of Transylvanian black-and-white foxes in Transylvania, *Scientific papers Animal Husbandry Series*, 50 (12).
- Dinescu, S. & Tontsch, A.M. (2002). *Cattle breeding for milk*. Bucharest, RO: Ceres Publishing House.
- Drinceanu, D. (1994). *Animal nutrition*. Timișoara, RO: Euroart Publishing House.
- Georgescu, G., Ujică, V., et al. (1998). *Cattle raising manuscript*. vol. IV, Bucharest, RO: Ceres Publishing House.
- Georgescu, G., et al. (2007). *The book of milk processing*. Vol. 2, Bucharest, RO: Ceres Publishing House.
- Georgescu, G., Ujică, V., et al. (1990). Cattle breeding technology. Bucharest, RO: Didactică și Pedagogică Publishing House.
- Gîlcă, I., et.al. (2005). Study of the productive longevity of the purebred bulls with Băltată cu negru românească (BNR) breed raised in the households of the population from the area of the commune of Sulița commune, Botoșani county - România, *Scientific papers, Animal husbandry and animal biotechnology*, 13, 172, Chișinău.
- Gîlcă, I., & Dolış, M. (2006). *Animal raising technologies*. Iași, RO: ALFA Publishing House.
- Groen, A.B.F. (2000). *Selezione per bovine productive longeve Bianco Nero*.
- Halga, P., et al. (2005). Animal nutrition and feeding. Iași, RO: ALFA Publishing House.
- Lupan, V., Chilimaru, S., & Ujică, V. (1997). *Cattle breeding technology*. Chișinău, MD: Tipografia Centrală Publishing House.
- Maciuc, D., Maciuc, V., & Creangă, Ş. (2009). *C.O.P. manual of utilization*, R.G. Iași, RO: "Ion Ionescu de la Brad" Publishing House.
- Maciuc, V. (2012). *Cattle breeding*. Botoșani, RO: Tehnică Publishing House.
- Maciuc, V., Leonte, C. & Radu-Rusu, R. (2015). *Cattle raising manual*. Iași, RO: ALFA Publishing House.
- Neamț, R. (2004). Cattle feeding in breast rest. "Crescătorul arădean" Magazine, III(10).
- Păcală, N. (2000). *Animal reproduction biology*. Timișoara, RO: Mirton Publishing House.
- Stoica, G. & Vladu, M. (2002). Cattle exploitation in households. "Zootehnie și Medicină Veterinară" Magazine, 2, Bucharest.
- Şonea, A. (2003). *Animal physiology*. Vol. 1, 2, 3, Bucharest, RO: Ceres Publishing House.
- Ujică, V., Maciuc, V., Nistor, I., Nistor, C.E., Cozma, D., Grigoroșcuță, G., Dascălu, C., Şonea, C. & Pântia, I.R. (2011). Contributions to the study of productive performance in the BNR cattle population in the North-East of the country. *International Scientific Symposium, Agrarian National University*, Chișinău
- Velea, C., & Mărginean, G. (2004). Animal production, reproduction, and breeding. Vol. III, Bucharest, RO: Agrotehnica Publishing House.
- www.anarz.eu
www.registregenealogice.ro
www.pedigriu.ro