

Estimates of Phenotypic Parameters for Milk Production Traits in Romanian Black Spotted Breed Dairy Cows

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Abstract:

The present study was designed to evaluate the phenotypic parameters (milk, fat, protein) in a herd of 120 Romanian black spotted dairy cows, in the third lactation, from Dambovita farm, Timis County. Milk samples were collected each day for 305-day lactation. Lactation records for milk, fat, and protein production of dairy cows were analyzed by fitting a multiple trait animal model using restricted maximum likelihood. Results indicated that average milk yield in the studied herd was 5493.78 ± 991.11 kg; fat yield 212.53 ± 37.85 kg and protein yield 173.26 ± 31.13 kg. The mean percentage of fat in the milk was 3.9 while that of protein was 3.2. Values of phenotypic correlation estimated between total 305-day milk, fat, and protein yields ranged from 0.88 to 0.92. Between milk production, milk fat percentage and protein percentage, it was a negative correlation of -0.26 and -0.24 respectively. For all parameters examined, phenotypic variability was moderate (less than 20%) which indicates a relatively homogeneous nucleus. The existence of strong positive correlation between milk production and fat yield, but especially between milk production and protein yield, help the farmers to make the selection of plus variations and to increase the production.

Keywords: lactation, milk, protein, fat, correlation

1. Introduction

Cattle, is one of the main branches of livestock due to high impact on the food market. Although the main traits are of relative importance, being different from one country to another, depending on consumer needs, milk production has remained the main goal pursued in the selection programs in each country [1, 2]. Until recent decades, the selection of dairy cattle production was done taking into account the amount of milk and/or fat yield, but considering that an increasing amount of milk is processed into cheese, the emphasis is on increasing the protein yield. In France, dairy cows

breeders use an optimum protein and fat yield ratio of 1.2 to 1 [3].

The main objectives of this study are to estimate variance components and phenotypic parameters for 305-day milk yield, for Romanian black spotted breed reared in Dambovita farm, from Timis County.

2. Materials and methods

Data were extracted from the Office for Improvement and Reproduction in Animal Husbandry Timis files. They comprised the third lactation records of dairy cows belonging to the Romanian black spotted breed, from Dambovita farm, Timis County. Daily milk yield record was

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calculated as the sum of milk recorded in the morning and evening. Milk samples were collected at the afternoon milking and analyzed using Milk - Scan Analyzer. Yield traits were expressed for 305-day. Shorter or longer lactations were corrected by the multiplicative factor of the dairy sire evaluation scheme [4].

Corrected yield = total yield \times 385 / (L + 80) where L = length of lactation.

Primary data processing method was performed by REML (Restricted Maximum likelihood), which guaranteed to obtain estimates in the normal space of the parameters, using SAS Version 9.1. Statistics software [5]. The following variables were analysed: milk yield, fat and protein yield, fat and protein contents and phenotypic correlation coefficient (rp).

3. Results and discussion

We chose to study the productive performance of these multiparous cows because, in general, milk production in cows increases progressively from lactation I to lactation V, then gradually decreases until the end of their productive lives. Currently, due to intensive breeding programs, maximum productive performance in some dairy cows' populations is get in the third or fourth lactation. For the 120 Romanian black spotted dairy cows, the number of records as well as the phenotypic mean and standard deviations for all milk traits are given in Table 1.

achieved in the maximum lactation. In the Serbian Holstein a higher milk yield in the third lactation of 6937 ± 1686 kg was found [6]. Maciuc (2010) [7] and Popescu et al. (2010) [8] studying the productive life of Romanian black and white populations, also found in the third lactation a higher mean milk yield of 5694.84 kg and 6670 kg respectively, compared with the herd of Romanian black spotted from Dambovită farm. The phenotypic mean of milk yield (5905 kg), registered in the Tunisian Friesian was also higher than in Romanian breed [9]. In change Rekik et al (2009) [10], registered a lower milk yield (4329 kg) in Tunisian Friesian. Buckley et al (2000) [11] found a very close milk yield of 5499 kg in the third lactation of Ireland Friesian.

The fat yield in the studied herd averaged 212.53 ± 2.49 kg. The smallest amount of fat in milk was 152.8 kg and 333.0 kg highest. The coefficient of variation for the fat yield was 17.81%, indicating the relative homogeneity of multiparous cows in the herd studied. Maturity equivalent for the fat yield was 219.12 kg. Logar (2007) [6] reported a much higher fat yield of 280.9 ± 74.8 kg in the Serbian Holstein dairy cows in the third lactation. Popescu et al (2010) [8] and Maciuc (2010) [7] found in Romanian Black and white populations in a third lactation, a fat yield of 275.69 kg, and 226.62 kg respectively. A little higher fat yield of 217 kg, in the third lactation in Ireland Friesian was found by Buckley et al (2000) [11]. In contrast, in Tunisian Friesian fat yield registered

Table 1. Phenotypic mean and variability of milk production in multiparous Romanian Black Spotted cows - Dumbrăvița farm

Trait	UM	n	Mean \bar{x}	Variance $\pm S^2$	Standard deviation $\pm S$	Coefficient of variability s%	Standard error $\pm \frac{\bar{S}}{\sqrt{x}}$	Variability limits min - max	E.M
Milk yield	kg	120	5493.78	982.3	991.11	18.04	65.35	4174 8368	5697.04
Fat yield	kg	120	212.53	1432.89	37.85	17.81	2.49	152.8 333.0	219.12
Protein yield	kg	120	173.26	969.24	31.13	17.96	2.05	128.1 264.0	178.45

Results show that the average milk yield throughout the dairy herd of 120 heads studied was 5493.78 ± 65.35 kg. In the herd there were cows with low yield (minimum - 4174 kg) and cows that have exceeded 8000 kg / lactation (up to - 8368 kg). The coefficient of variation was 18.04%, which shows a herd of cows with medium variability of milk yield. Average yield of milk in the studied cows is located just below the maturity equivalent of 5697.04 kg, which can be

was much lower: 180.23 kg [9] and 172 kg [10] respectively. Due to high heritability of over 0.90, this parameter can be improved by phenotypic selection.

Milk proteins have a high degree of assimilation (95 - 97%). Peculiarities of these proteins require the use of milk and dairy products rich in protein as a permanent part of the rational nutrition. The protein yield, a decisive criterion in the selection of dams in the herd, was 173.26 ± 2.05 kg, with

amplitude of variation of 128.1 kg to 264.0 kg. For this phenotypic parameter coefficient of variability was 17.96%, which shows an average variation in the protein yield. In the Serbian Holstein dairy cows (third lactation) protein yield registered was much higher (223.7 ± 56.5 kg) [6]. Higher production of protein yield, compared with that of studied heifers from Dambovită, there have been registered by Popescu et al. (2010) [8] and Maciuc (2010) [7] in Romanian black and white breed, of 220.75 kg and 194.87 kg protein yield respectively. Buckley et al. (2000) [11] found 185 kg protein yield in the third lactation Ireland Friesian. Otherwise, a lower protein yield of 167.83 kg [9] and of 1655 kg [10] respectively was found in Tunisian Friesian. The average protein yield in multiparous dairy cows, stood a little above 178.45 kg, which was the value calculated for the maturity equivalent. The results obtained can be exploited for choosing bull dams, eliminating the selection of individuals who were below standard values for this character.

Milk fat content is one of the most important components both economically and nutritionally

Table 2. Phenotypic mean and variability of fat and protein content in Romanian black spotted multiparous dairy cows - Dumbrăvița farm

Trait	% Fat	% Protein
n	120	120
Mean \bar{x}	3.9	3.2
Variance $\pm S^2$	0.22	0.18
Standard deviation $\pm S$	0.47	0.42
Coefficient of variability s%	12.05	13.29
Standard error $\pm S\bar{x}$	0.03	0.02
Variability Min	2.7	2.1
limits Max	5.5	4.9

and also for determining influence on sensory properties of milk and milk products manufactured. In some countries the price of milk is determined largely by the content of fat and protein. Phenotypic mean and variability of fat and protein content in Romanian black spotted multiparous dairy cows studied are given in Table 2.

Average fat content in the studied herd was $3.9 \pm 0.47\%$. For this phenotypic were recorded minus variants with a reduced-fat percentage of 2.7% but also 5.5% plus variants. The coefficient of variability for fat content was 12.05%, a value which indicates a homogeneous population. Milk

protein content in multiparous cows had an average of 3.2%, amplitude variability ranging among 2.1 and 4.9%. The coefficient of variability of 13.29% for this character production reveals a herd of dairy cows rather homogeneous. Milk protein content in the studied herd, had an average of 3.2% and an amplitude of variability among 2.1 and 4.9%. The coefficient of variability of 13.29% reveals a rather homogeneous herd of dairy cows. Compared with the studied herd from Dambovită farm, both Popescu et al (2010) [8] and Maciuc (2010) [7] found in Romanian Black and white populations in a third lactation a higher fat content of 4.13% and 4.02 respectively. They also found in their studies a higher protein content of 3.3% [7] and 3.34% respectively [8].

For choosing the appropriate methods of improvement, and for selection of bull dams, depending on the studied parameters, were estimated the phenotypic correlations among pairs of characters (Table 3).

Table 3. Estimates of phenotypic correlations for the third lactation milk yield traits in Romanian black spotted dairy cows – Dambovită farm

	MY	FY	PY	%F	%P
MY	-	0.88	0.92	-0.26	-0.24
FY	0.88	-	0.82	0.006	0.04
PY	0.92	0.82	-	-0.008	0.42
%F	-0.26	0.006	-0.008	-	0.30
%P	-0.24	0.04	0.42	0.30	-

MY = milk yield; FY=fat yield; PY= protein yield

F= fat percentage; %P= protein percentage

The relationship between milk and protein yields (0.92) was more pronounced than between milk and fat yield (0.88), for studied Romanian black spotted dairy cows. A close value of phenotypic correlation between milk and fat yield (0.84) was found in French Friesian [3]. On the other hand, Madsen et al (2009) [12], found for Danish Holstein in the third lactation, a higher correlation between milk and fat yield of 0.9, but a lower correlation between milk and protein yield (0.76). Jamrozik et al (1998) [13], found in Canadian Holstein a lower correlation of 0.85 between milk and fat yield in the third lactation, but a higher phenotypic correlation of 0.93 between milk and protein yield. Correlation between fat and protein yield (0.82) was lower than 0.89 found in French Friesian dairy cows for the third lactation [3]. The antagonistic correlation between milk yield and fat content (-0.26) was of very close value with the

correlation between milk and protein yield (-0.24). The same value (-0.26) for the milk and fat content correlation, was found in French Friesian [3]. Relationships between contents and yields of constituents were lower, and in some cases not significantly different from zero. A correlation close to zero was observed between fat yield and fat content (0.006). In contrast, in the third lactation for the French Friesian, was found a phenotypic correlation much higher (0.30) [3]. Correlation between protein yield and protein content was much higher (0.42) than that found in the French Friesian of 0.06 [3].

4. Conclusions

For all five phenotypic parameters analyzed in the herd of dairy cows from the farm Dumbrăvița, variability was moderate (less than 20%) which indicates a relatively homogeneous nucleus. The existence of strong positive correlation between milk production and amount of fat, but especially between milk production and the amount of protein, come as support offered to farmers to assist them in achieving further selection variants, bull dams and for the efficiency of production. The possible decrease in protein content which would have negative technological consequences cannot be totally neglected. Therefore the selection criterion may lead to a slight decline of protein content which must be compensated by a greater emphasis laid on selection for protein content. A selection based on the correlation between the fat and protein content is not indicated, since it decreases fat content instead of increasing protein content which is less variable. The herd must continue monitored, and if the protein content decline, it will be necessary a new selection goal, which will maximizes fat and protein yield, while maintaining protein content.

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