ESTIMATION OF GENETIC ADDITIVE VARIANCE OF MILK PRODUCTION IN DAIRY ROMANIAN BLACK SPOTTED BREED FROM PESTREŞTI-ALBA FARM

ESTIMAREA VARIANȚEI GENETICE ADITIVE A PRODUCȚIEI DE LAPTE LA VACILE DIN RASA BĂLȚATĂ CU NEGRU ROMÂNEASCĂ DE LA FERMA PETREŞTI-ALBA

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The objective of this study was to estimate the heritability of milk, milk fat and milk protein productions in Romanian Black Spotted breed cattle from SC Dorin&Sanda SRL private farm, Petreşti-Alba. A total of 101 lactations cows were used to estimate heritability variabilites among milk yield (kilograms), fat and protein content. The data were collected over a period of two years (2006-2007). Heritabilities were 0.31, 0.68 and 0.73 for milk yield, fat content and protein content, respectively. Heritabilities were among the limits found in the literature. Data can be use as a guide for selection to improve milk yield while maintaining fat and protein contents.
Key words*: heritability, dairy cow, milk, fat, protein*

Introduction

Romanian Black Spotted breed is the most important breed of dairy cows in Romania. The selection objectives are to increase the total amount of milk yield, while maintaining or increase the contents of fat and protein. Herd production and reproduction influence dairy cattle profitability. To improve the reproductive performance of their herds, dairy producers must understand the complex interactions of milk production, reproduction, nutrition, genetics and management. Milk production is more heritable than other traits, and genetic gains in milk production for the last 30 years have been substantial. Heritability is one of the most important concepts in animal breeding and is used to help plan breeding programs, determine management strategies, estimate breeding values of individual animals, and predict response to selection. The objective of this study was to estimate the heritability of milk, milk fat and milk protein productions in Romanian Black Spotted breed cattle.

Materials and Methods

Records for milk yield (in kilograms per lactation) and lactation content for fat and protein in four groups of paternal half-sisters from a herd of 101 individuals from Romanian Black Spotted breed has been used. This study included those animals which had completed at least one lactation record. Data corresponded to milk yield and fat and protein contents were recorded between 2006 and 2007 for 305 days of lactation. Heritabilities were estimated by analyzing the variance of half-sisters groups. The method supposes the establishing of total phenotypic variance and it's decomposition in variance between half sisters groups (variance between fathers); variance out of half-sister group (variance between males); variance between mothers of the same half-sister group and variance between the offspring's of the same dam.

Results and Discussions

A major aim of daily cattle breeders is to breed cattle for high milk production. This is a function of several variables, chief among which are maximal daily production and rate of decline in production from the time of maximum production, i.e., persistency of lactation. The several physiological processes contributing to total yields of milk in lactation may be affected differently by environmental and hereditary components, i.e., have different heritabilities. Heritability is used to calculate genetic evaluations, to predict response to selection, and to help producers decide if it is more efficient to improve traits through management or through selection. This guideline highlights definitions and uses of heritability and lists estimates of heritability for several important traits in dairy cattle breeding. Heritability tells the breeder how much confidence to place in the phenotypic performance of an animal when choosing parents of the next generation. Production traits like milk or protein yield are moderately heritable, with a h^2 from 0.15 to about 0.40. Product quality traits such as fat and protein percent tend to have higher heritabilities, above 0.40. For estimating the coefficient of heritability for milk production was analyzed the variance of half-sister group. The analysis of variance, estimates of variance components, and estimate of heritability are presented in tables below.

Variance between groups due to the sires is lower than the phenotypic variance inside the dams groups. As result of heritability estimation for milk yield in the herd, the value of additive genetic variance that was estimate is 0.31, while the difference devolves on the residual genetic variance and environment. Heritability value of 0.31 is situated among the normal values for this parameter in the literature, between 0.30 and 0.35.

Table 1

Heritability coefficients for milk yield

Variability	Sx^2	S^2	DF
Total variability	17431703	1743170.30	100
Variability between groups (M)	16182862.8	5 394 287.6	3
Variability inside the group (D)	192877171.2	2 009 137.2	96
$h^2 = 0.31$			

For estimating the heritability coefficient of fat content, the half-sister group variance analyze was made. Obtained results are present in Table 2.

Table 2

Heritability coefficient for fat content

Variability	Sy^2	S^2	DF
Total variability	251462	2514.16	100
Variability between groups (M)	40282.5	13427.5	3
Variability inside the group (F)	263990.4	2749.9	96
$h^2 = 0.68$			

Variance among groups is lower than variance inside the group. After estimation of heritability coefficient for fat yield, result a value of 0.68 which means that 68% from total variance is determined by additive genetic variance while the difference of 32% is due to the residual genetic variance and environment. In literature the heritability values for this parameter is situated between 0.68 and 0.78.

Estimates of variance components and heritability for 305-day protein content are presented in Table 3.

Table 3

Heritability for protein content

Variability	Sz^2	S^2	GL
Total variability	192142	1921.42	100
Variability between groups (M)	28161.03	9387.01	3
Variability inside the group (F)	55537.92	578.52	96
$h^2 = 0.73$			

Variance due to the sires is lower than the phenotypic variance from inside the dams groups. The estimated heritability coefficient for this parameter was 0.73 which means that this character is determined by additive genetic interactions in 73% proportions. The remaining variation among sire groups is assumed to be additively genetic and that within groups assumed to be random environmental variation including variation due to dominance and epistasis. Data from literature situate this parameter between 0.70 and 0.75.

Conclusions

1. The estimated heritability for milk yield was 0.31, and this value shows that this trait has a low genetic additive load.

2. In the milk fat content was estimated a genetic additive weight of 68%, and 32% is due to the genetic non-additive interaction and environmental variance.

3. Protein content with a heritability coefficient of 0.73 can be improved by selection.

4. The estimated heritability value for milk yield is in agreement with most reports of other researches. The results of this study can be used by breeders in their breeding plans, and to help them to take the best decisions.

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