Relationships Between Productive and Reproductive Traits in Maramureș Brown Breed from Subcarpathian Area of Romania

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Abstract

The aim of the present study was to evaluate the relationship between productive and reproductive traits in Maramureș Brown breed raised in sub-Carpathian farms from Romania. The research was based on productive and reproductive records collected between 2017 and 2023 from farms located in Argeș, Dâmbovița and Prahova counties. A total of 1,150 valid individual records were included in the final statistical analysis. The analysed productive traits included milk yield standardized to 305 days, fat percentage, protein percentage, EBV milk and EBV fitness, while the reproductive traits included age at first calving, services per conception and calving interval. The average milk yield recorded in the analysed population was 5,539.55 kg, while the mean calving interval was 387.58 days. Weak negative correlations were identified between milk production and reproductive traits, suggesting that higher productive levels were not clearly associated with reduced fertility under the studied farming conditions. A moderate positive correlation was observed between milk yield and EBV milk (r = 0.404). The obtained results suggest that Maramureș Brown breed from may maintain a relatively balanced productive-reproductive profile under semi-intensive farming systems specific to subcarpathian area of Romania.

Keywords: Maramureș Brown breed, milk production, reproductive performance, calving interval, fertility, Romania

1. Introduction

Maramureș Brown breed are appreciated for their adaptability, productive longevity and balanced milk composition. Compared with highly specialized dairy breeds, this breed is considered more suitable for hilly and mountain regions, where feeding conditions and farm management may vary considerably between herds. In Romania, Maramureș Brown breed continue to play an important role especially in sub-mountain areas, where farms aim not only for good milk production, but also for fertility, resistance and productive stability.

Reproductive efficiency directly influences the economic performance of dairy farms. Parameters such as age at first calving, services per conception and calving interval are commonly used for the evaluation of reproductive management at herd level. Prolonged calving intervals or increased insemination requirements may reduce farm profitability by increasing maintenance costs and decreasing productive efficiency [1-3].

Milk production and fertility should not be analysed separately because productive pressure may influence reproductive performance. In highly intensive dairy systems, elevated milk production is frequently associated with reduced fertility and increased reproductive disorders. However, the intensity of this relationship differs

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depending on breed, management system and environmental conditions [4-9].
Regarding cattle farming, Romania currently has 2.162.013 cattle, dairy cows are 1.231.857 heads, which means 57% [1].
Previous studies performed on Brown populations reported that Maramureș Brown breed may maintain relatively stable reproductive performances under semi-intensive farming conditions. Compared with highly specialized Holstein populations, Brown cattle breeds are often characterized by better adaptability and a more balanced productive-reproductive profile.
The objective of the present study was to evaluate the relationship between productive and reproductive traits in dairy cattle from Maramureș Brown breed raised in farms located in Argeș, Dâmbovița and Prahova counties. The study focused on the analysis of milk production, milk composition, EBV values and the main reproductive indicators in order to characterize the productive-reproductive profile of the analysed population.

2. Materials and methods

The study was carried out using productive and reproductive records collected from Maramureș Brown breed farms located in the subcarpathian area of Romania, specifically in Argeș, Dâmbovița and Prahova counties. The analyzed period covered the years 2017–2023.
The initial database included records collected from 28 farm sheets. After database verification and removal of summary rows, a total of 1,150 valid individual records were retained for the final statistical analysis. The distribution of records by county was as follows: 328 records from Prahova, 467 records from Argeș and 355 records from Dâmbovița.
The analyzed productive traits included:

- milk yield standardized to 305 days;
- fat percentage;
- protein percentage;

The analyzed reproductive traits included:

- age at first calving;
- services per conception;
- calving interval.

Milk production was standardized to 305 days according to the methodology used in official dairy recording systems. Before statistical processing, the database was checked for biologically implausible values or spreadsheet formatting errors. These values were excluded from the final analysis.
The final dataset was statistically processed using arithmetic mean, standard deviation (SD), standard error of the mean (SEM), coefficient of variation (CV%) and Pearson correlation coefficients. Correlations between productive and reproductive traits were interpreted considering the practical conditions specific to commercial dairy farms from subcarpathian area of Romania.
The present study was based on field data collected from commercial farms, where feeding conditions, reproductive management and replacement strategies were not completely uniform between herds. Therefore, the obtained results should be interpreted in the context of practical farming conditions specific to semi-intensive dairy systems.

3. Results and discussion

The final dataset included 1,150 valid individual records collected from Maramureș Brown breed (dairy cattle) raised in farms located in Argeș, Dâmbovița and Prahova counties.
The average milk yield standardized to 305 days was 5,539.55 kg, with a standard deviation of 859.92 kg and a coefficient of variation of 15.52%. The average fat percentage recorded in the analyzed population was 3.85%, while the average protein percentage was 3.34%. The mean age at first calving was 29.20 months, the average number of services per conception was 1.16 and the mean calving interval was 387.58 days.
At county level, the highest average milk yield was recorded in Dâmbovița County (5,771.56 kg), followed closely by Prahova (5,764.17 kg), while Argeș recorded a lower average production level (5,205.42 kg). Regarding milk composition, Dâmbovița recorded the highest average fat percentage (3.96%), followed by Argeș (3.94%) and Prahova (3.60%). There is an inverse correlation between milk production and the concentration of fat and protein in milk. As animals produce more milk, the fat and protein content tends to decrease [2].
The reproductive indicators also differed between counties. Dâmbovița recorded the lowest average number of services per conception (1.09) and the lowest age at first calving (27.28 months), suggesting a more favorable reproductive profile

under the analyzed farming conditions. Prahova recorded a slightly higher calving interval (391.82 days), despite maintaining one of the highest average milk yields.

Correlation analysis identified weak negative relationships between milk production and reproductive parameters. The correlation between milk yield and calving interval was r = -0.117 ($p<0.05$), while the correlation between milk yield and services per conception was r = -0.165 ($p<0.05$). These results suggest that higher productive levels were not clearly associated with reduced reproductive efficiency in the analyzed farms.

A moderate positive correlation was identified between milk yield and EBV milk (r = 0.404; $p<0.01$), indicating that animals with superior genetic value for milk production also achieved higher productive performances. A moderate negative correlation was observed between EBV milk and calving interval (r = -0.366), suggesting that animals with better productive genetic value did not present prolonged reproductive intervals under the studied farming conditions.

The obtained productive values were lower compared with those commonly reported in highly specialized Holstein populations raised under intensive dairy systems, where milk production frequently exceeds 9,000–10,000 kg per lactation. Lucy [6] reported calving intervals frequently exceeding 400 days in high-producing Holstein herds, whereas the population analyzed in the present study maintained a mean calving interval of 387.58 days.

Compared with highly intensive dairy systems, the Maramureș Brown cattle included in the present study appeared to maintain a more balanced productive-reproductive profile. The relatively moderate productive pressure identified in the analyzed farms may partially explain the weak correlations observed between productive and reproductive traits.

The results obtained in the present study support the idea that Bruna de Maramureș cattle may represent a suitable option for semi-intensive dairy systems from hilly and sub-mountain regions of Romania, where adaptability, fertility and productive stability are important production objectives.

Table 1. Descriptive statistics for the main productive and reproductive traits

Trait	n	Mean	SD	SEM	CV%
Milk yield 305 days (kg)	1150	5539.55	859.92	25.36	15.52
Fat (%)	1146	3.85	0.37	0.01	9.55
Protein (%)	1146	3.34	0.18	0.01	5.38
Age at first calving (months)	569	29.20	5.70	0.24	19.52
Services/conception	1146	1.16	0.24	0.01	20.39
Calving interval (days)	1041	387.58	27.69	0.86	7.14

Table 2. County-level means for productive and reproductive indicators

County	Milk yield (kg)	Fat (%)	Protein (%)	Services/ conception	Calving interval
Prahova	5764.17	3.60	3.38	1.14	391.82
Argeș	5205.42	3.94	3.35	1.22	385.31
Dâmbovița	5771.56	3.96	3.30	1.09	387.11

Table 3. Pearson correlations between productive and reproductive traits

Traits analyzed	r	Interpretation
Milk yield × Calving interval	-0.117	Weak negative correlation
Milk yield × Services/conception	-0.165	Weak negative correlation
Milk yield × EBV milk	0.404	Moderate positive correlation
EBV milk × Calving interval	-0.366	Moderate negative correlation

Table 4. Representative farm-level observations

County	Farm	Milk yield (kg)	Services/ Conception	Calving interval	Observation
PH	F1	6573.00	1.13	398.09	High milk production
PH	F2	6197.23	1.28	427.00	Longer calving interval
AG	F3	5988.57	1.06	387.64	Balanced profile
AG	F4	5742.00	1.18	390.12	Stable reproductive interval
DB	F5	5914.00	1.08	382.41	Good reproductive efficiency
DB	F6	5866.00	1.11	384.22	Stable productive profile

4. Conclusions

The analyzed Maramureș Brown cattle population maintained relatively balanced productive and reproductive performances under the farming conditions specific to the sub-Carpathian area of Romania.

The average milk yield standardized to 305 days was 5,539.55 kg, while the main reproductive indicators remained within limits considered acceptable for semi-intensive dairy farming systems. The average calving interval was 387.58 days and the average number of services per conception was 1.16.

Weak negative correlations were identified between milk production and reproductive parameters, suggesting that higher productive levels were not clearly associated with reduced fertility in the analyzed farms. A moderate positive correlation between milk yield and EBV milk highlighted the importance of genetic value in productive performance.

Compared with highly intensive dairy systems based on specialized breeds, the analyzed Maramureș Brown population appeared to maintain a more stable productive-reproductive balance under variable farm conditions.

The obtained results support the use of Maramureș Brown cattle in sustainable dairy farming systems from hilly and sub-mountain regions of Romania, where adaptability, fertility and productive stability represent important production objectives.

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