

## STUDY OF THE MILK QUALITY OBTAINED FROM FARMS IN NEAMŢ COUNTY

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### RESEARCH ARTICLE

#### Abstract

*In this paper, the analysis of milk quality in dairy cattle herds from seven farms in Neamţ County was realized. Based on seven specific indicators, the quality of milk was determined, as follows: somatic cell number (SCN), fat percentage (F%), protein percentage (P%), lactose proportion (L%), urea proportion (U%), and casein proportion (C%), and milk pH. The best results in milk quality were observed in Brună de Maramureş breed from Farm 5, where the average values for the specific indicators of milk quality in these cows were as follows: somatic cell number (SCN) - 157.64 thousand/ml, fat percentage (%) - 4.64, protein percentage (%) - 3.73, lactose percentage (%) - 4.84, urea percentage (%) - 23.37, casein percentage (%) - 28.78. The least favorable average values for SCN were found in farm 4 (466.78 thousand/ml), for fat percentage in farm 2 (3.84%), for protein percentage in farm 2 (3.32%), for lactose percentage in farm 1 (4.39%), for urea percentage in farm 1 (38.46%), casein percentage in farms 1 (27.69%), for milk pH in farm 3 (6.86), where the farm management needs to undergo significant changes.*

**Keywords:** cattle, dairy, quality, milk, farm.

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#### INTRODUCTION

Milk is a product of mammary glands with a density of 1.026-1.034 g/cm<sup>3</sup> at a temperature of 20°C; it boils at 100.2°C, and freezes at -0.55°C. Milk is considered a complete and complex food, containing over 100 essential substances in the human diet, including 20 amino acids, 10 fatty acids, 25 vitamins, and 45 minerals (Dias et al., 2019).

The chemical composition of cattle milk is quite variable, depending on several factors. On average, it contains water (87.5%) and dry matter (12.5%), which consists of basic nutrients for human nutrition. The primary components include fats (3.3-4.5%, with an average of 3.5%), protein (3.2-3.4%), lactose (4.8%), and ash (1.0%) (Maciuc, 2006).

However, milk also serves as an excellent environment for various types of bacteria. It is essential to implement self-monitoring programs at the level of each authorized milk-producing facility by all producers to ensure milk quality (Maciuc, 2012).

An important indicator of milk quality is the pH level, which is used to test for impurities, damage, and signs of mastitis infection. The pH value reflects the concentration of hydrogen ions

in the milk, indicating its active acidity. Normal milk is slightly acid, with a pH range of 6.6-6.8 (Baul, 2009). Regarding the number of somatic cells (SCN) per milliliter for raw milk, it should be less than 400.000; an excellent health status is less than 250.000 (Ciocan-Alupii et al., 2022).

#### MATERIAL AND METHOD

In this paper, we have analyzed specific indices related to milk quality, including somatic cell number (SCN), fat percentage (F%), protein percentage (P%), lactose proportion (L%), urea proportion (U%), the proportion of casein (C%), and milk pH.

The studied herd consisted of 152 cows from the following breeds: Bălţată cu Negru Românească (BNR), Holstein, Brună de Maramureş, and Bălţată Românească (BR). The primary data were extracted from the Association of Cattle Breeders from Mureş County, the Association of Animal Breeders "Operator IA" Neamţ, and the Genealogical Register of the breed. These data were systematized, statistically processed, and interpreted using methods specific to such research.

The statistical parameters include the average or median represented by the variance

and the standard deviation of the studied characteristics.

To perform these calculations, we used the computer program S.A.V.C. (Statistical Analysis of Variance and Covariance 2003). This program allowed to determine the arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%) for the specific indicators studied concerning milk production quality.

## RESULTS AND DISCUSSIONS

Table 1 presents data on the average values and variability of somatic cell numbers in the milk produced on the seven farms under study. It is evident that the highest average value was recorded on Farm 4, with an average of  $466.78 \pm 207.12$  thousand cells per milliliter of milk.

The coefficient of variation is exceptionally high, reaching 133.11% due to the great range of values for this parameter. The high values observed on Farm 4 indicate the presence of mastitis cases in the dairy cow herd, likely caused by pathogens such as *Escherichia coli*,

*Staphylococcus aureus*, and *Streptococcus agalactiae*. These infections may result from inadequate hygiene conditions in the shelters, improper milking practices, suboptimal milking equipment, and improper milk handling and storage.

Farmers should pay close attention to preventing mastitis, as it can lead to significant economic losses due to the high treatment costs, reduced milk production in terms of both quantity and quality, and even to replace of affected animals.

Farm 5 exhibited the most favorable average value for this indicator, with  $157.64 \pm 16.92$  thousand cells per milliliter. The range of variation is relatively wide, with a minimum of 27.00 thousand cells per milliliter of milk and a maximum of 521.00 thousand cells per milliliter. The lower somatic cell count in the milk from cows on this farm can be directly attributed to the feeding conditions, and, in particular, the maintenance and sanitation standards maintained there.

It should be noted that no results regarding somatic cell numbers were available in the database for Farms 6 and 7, where the Bălțată Românească breed is raised.

Table 1

Average values of somatic cell count (SCN) (thousand/ml)

Indicators	$\bar{X}$	$\pm s$	s	V%	Min	Max
Farm 1	284.70	76.58	419.49	147.34	18.00	1761.00
Farm 2	362.50	41.10	82.20	22.67	270.00	450.00
Farm 3	392.26	97.60	543.46	138.54	7.00	2414.00
Farm 4	466.78	207.12	621.36	133.11	22.00	1755.00
Farm 5	157.64	16.92	116.03	73.60	27.00	521.00
Farm 6	0.00	0.000	0.000	0.000	0.00	0.00
Farm 7	0.00	0.000	0.000	0.000	0.00	0.00

arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%); min. (minimum value); max. (maximum value)

Regarding the proportion of fat in the milk obtained from the studied farms, Table 2 displays the data. It is evident that the highest statistical average was observed on Farm 5, with an average value of  $4.64 \pm 0.15\%$ . The standard deviation reached its maximum value at  $s=0.62$ , resulting in a coefficient of variability of  $V\%=13.45$ . The fat content ranged between 3.29% and 5.65%, indicating a moderately homogeneous cow population.

In contrast, the lowest average fat content was recorded at Farm 2, with a mean of  $3.84 \pm 0.24\%$ . Here, the standard deviation reached its peak at  $s=0.96$ , resulting in a high coefficient of variability,  $V\% = 24.99$ . The fat

content variations ranged from 1.82% to 5.09%, suggesting a heterogeneous population in terms of milk fat content on this farm. Consequently, special attention from the farmer is necessary in the selection and management of matings. Knowledge of individual performances such as milk quantity, fat percentage, and protein percentage is crucial for selecting the parents of the next generation (Diavao et al., 2023).

Table 2

Average values of fat percentage (F%) of milk

Indicators	$\bar{X}$	$\pm s \bar{x}$	s	V%	Min	Max
Farm 1	4.11	0.15	0.84	20.42	2.33	5.97
Farm 2	3.84	0.24	0.96	24.99	1.82	5.09
Farm 3	4.10	0.19	1.06	25.86	2.49	6.23
Farm 4	3.86	0.25	0.77	20.01	2.60	4.90
Farm 5	4.64	0.15	0.62	13.45	3.29	5.65
Farm 6	3.97	0.16	0.42	10.81	3.63	4.85
Farm 7	4.50	0.13	0.35	7.81	3.94	4.93

arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%); min. (minimum value); max. (maximum value)

The data presented in Table 3 regarding the proportion of milk protein obtained from the seven farms under study reveal that the highest average value was observed on Farm 5, with a mean of  $3.73 \pm 0.04\%$ . The standard deviation reached its maximum value at  $s=0.04$ , resulting in a coefficient of variation of  $V\%=6.13$ . The protein content ranged from a minimum of  $3.45\%$  to a maximum of  $4.17\%$ ,

indicating a relatively homogeneous cow population in terms of milk protein content.

Conversely, the lowest average value was recorded on Farm 2, with an average value of  $3.32\% \pm 0.07\%$ . Here, the standard deviation reached its peak at  $s=0.422$ , resulting in a coefficient of variability of  $V\%=12.68$ . The protein content varied between a minimum of  $2.93\%$  and a maximum of  $4.95\%$ .

Table 3

Average values of protein percentage (P%) of milk

Indicators	$\bar{X}$	$\pm s \bar{x}$	s	V%	Min	Max
Farm 1	3.53	0.08	0.43	12.35	2.90	4.40
Farm 2	3.32	0.07	0.42	12.68	2.93	4.95
Farm 3	3.37	0.08	0.33	10.05	2.78	4.15
Farm 4	3.36	0.13	0.41	12.27	2.73	3.87
Farm 5	3.73	0.04	0.22	6.13	3.45	4.17
Farm 6	3.35	0.16	0.43	13.09	2.96	4.28
Farm 7	3.48	0.07	0.19	5.70	3.10	3.76

arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%); min. (minimum value); max. (maximum value)

The data in Table 4 regarding the proportion of lactose in milk obtained from the seven farms under study indicate that this indicator had the highest average value on Farm 5, with a mean of  $4.84 \pm 0.02\%$ . The standard deviation reached its maximum value at  $s=0.08$ , resulting in a reduced coefficient of variability of  $V\%=1.75$ . The lactose content ranged from a minimum of  $4.77\%$  to a maximum of  $5.06\%$ ,

highlighting the presence of a homogeneous population.

Conversely, the lowest proportion of lactose in milk was recorded on Farm 1, with a mean of  $4.39 \pm 0.04\%$ . Here, the standard deviation reached its peak at  $s=0.13$ , resulting in a coefficient of variation of  $V\%=2.97$ . The lactose content varied between a minimum of  $4.18\%$  and a maximum of  $4.50\%$ .

Table 4

Average values of lactose percentage (L%) of milk

Indicators	$\bar{X}$	$\pm s \bar{x}$	s	V%	Min	Max
Farm 1	4.39	0.04	0.13	2.97	4.18	4.50
Farm 2	4.76	0.03	0.12	2.62	4.56	4.98
Farm 3	4.75	0.03	0.12	2.62	4.55	4.97
Farm 4	4.68	0.07	0.22	4.89	4.29	5.04
Farm 5	4.84	0.02	0.08	1.75	4.77	5.06
Farm 6	4.65	0.01	0.06	1.33	4.54	4.78
Farm 7	4.63	0.064	0.168	3.636	4.45	4.84

arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%); min. (minimum value); max. (maximum value)

The data regarding the milk urea content obtained from the seven farms under study are presented in Table 5. It is evident that the lowest average value was observed on Farm 7, with a mean of  $22.44 \pm 2.37\%$ . The coefficient of variation is relatively high at  $V\%=28.01$ , with a range from a minimum of 16.40% to a maximum of 33.60%.

Conversely, the highest average value was recorded on Farm 1, with a mean of  $38.46 \pm 2.75\%$ . The coefficient of variation is very high at  $V\%=33.89$ , with a range from a minimum of 10.90% to a maximum of 53.90%.

Table 5

Average values of urea percentage (U%) of milk

Indicators	$\bar{X}$	$\pm s$	s	V%	Minimum	Maximum
Farm 1	38.46	2.75	13.03	33.89	10.90	53.90
Farm 2	29.10	1.88	7.52	25.85	18.40	45.90
Farm 3	34.93	1.47	8.22	23.55	18.62	47.30
Farm 4	26.49	2.62	7.85	29.66	13.30	35.20
Farm 5	23.37	0.68	5.76	24.65	11.00	39.90
Farm 6	33.17	4.44	11.76	35.47	19.70	46.10
Farm 7	22.44	2.37	6.28	28.01	16.40	33.60

arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%); min. (minimum value); max. (maximum value)

An important indicator that characterizes the quality of milk is the proportion of casein, which is the main protein in milk. From the data presented in Table 6, it can be observed that the highest average value was recorded on Farm 5, with a mean of  $28.78 \pm 0.87\%$ . The standard deviation reached its maximum value at  $s=5.21$ , resulting in a coefficient of variation of  $V\%=17.81$ . The variation limits ranged between 22.59% and 36.71%.

Conversely, the lowest average value was registered on Farm 1, with a mean of  $27.69 \pm 0.87\%$ . The coefficient of variation was 11.86, with a minimum limit of 22.70% and a maximum of 32.75%. It's worth noting that Farm 1 raises the Bălțată cu Negru Românească breed. For Farms 2, 6, and 7, no data on this indicator were recorded.

Table 6

Average values of casein percentage (C%) of milk

Indicators	$\bar{X}$	$\pm s$	s	V%	Min	Max
Farm 1	27.69	0.87	3.28	11.86	22.70	32.75
Farm 2	0.00	0.000	0.000	0.000	0.00	0.00
Farm 3	27.78	0.96	3.41	11.31	22.60	31.86
Farm 4	27.72	0.79	2.38	8.60	24.72	30.81
Farm 5	28.78	0.78	5.21	17.81	22.59	36.71
Farm 6	0.00	0.000	0.000	0.000	0.00	0.00
Farm 7	0.00	0.000	0.000	0.000	0.00	0.00

arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%); min. (minimum value); max. (maximum value)

The data regarding milk acidity (pH) is presented in Table 7, which reveals that the highest average value was observed on Farm 3, with a mean of  $6.86 \pm 0.04$ . The coefficient of variation was 4.25, and the pH ranged from a minimum of 6.46 to a maximum of 7.40.

Conversely, the lowest average value was recorded on Farm 5, with a mean of  $6.60 \pm 0.01$ .

The coefficient of variation was quite low at  $V\%=0.75$ , and the pH varied from a minimum of 6.50 to a maximum of 6.70.

It's important to note that there is no data available for Farms 2, 6, and 7 regarding the pH value.

Table 7

## Average values of milk pH

Indicators	$\bar{X}$	$\pm s$	s	V%	Min.	Max.
Farm 1	6.70	0.01	0.05	0.80	6.61	6.82
Farm 2	0.00	0.000	0.000	0.000	0.00	0.00
Farm 3	6.86	0.48	0.29	4.25	6.46	7.40
Farm 4	6.72	0.02	0.08	1.22	6.61	6.85
Farm 5	6.60	0.01	0.05	0.75	6.50	6.70
Farm 6	0.00	0.000	0.000	0.000	0.00	0.00
Farm 7	0.00	0.000	0.000	0.000	0.00	0.00

arithmetic mean ( $\bar{X}$ ), the error of the arithmetic mean ( $\pm s$ ), standard deviation (s), the coefficient of variability (V%); min. (minimum value); max. (maximum value)

## CONCLUSIONS

The study yields several key conclusions:

- The best milk quality results were observed in Brună de Maramureș breed from Farm 5, or Secuieni Neamț Agricultural Research and Development Station. The milk from these cows exhibited lower somatic cell numbers (SCN), higher fat percentage, protein percentage, and casein percentage, and an optimal milk pH. This is attributed to the feeding conditions on the farm.
- Farms 4 and 3 had high somatic cell counts, indicating potential issues with hygiene in cow shelters and milking parlors. These elevated somatic cell counts can result from mastitis or other udder diseases in cows. Strategies to mitigate these issues are necessary to maintain milk quality and cow health.
- Farm 5 had the highest fat content in milk, while Farm 2 had the lowest.
- Farm 5 also had the highest protein content in milk, primarily due to the Brună de Maramureș breed raised on the farm.
- The highest average casein content was recorded on Farm 5, while Farm 1 had the lowest. Milk from Farm 5 is especially suitable for the cheese industry due to its high casein content.
- Lactose content was highest on Farm 5, which is important for various dairy product production, such as cheese and yogurt.

- The milk urea content on all seven farms exceeded the optimal range, indicating suboptimal feed protein utilization. Farms 5 and 7 had better-balanced protein in their feed rations. Farmers should pay attention to this indicator to avoid excessive feed costs and potential reproductive disorders.
- In summary, improving feed quality and hygiene practices in shelters and milking parlors can lead to better milk quality, increased economic efficiency, and enhanced cow health. Proper selection, breeding, and nutrition management are crucial for optimizing milk quality and maintaining a healthy and productive dairy herd.

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