Study on Milk Production Dynamics and Major Chemical Milk Components in Brown Sire Dams of Brown Swiss-Type from the Research and Development Station for Bovine Raising - Arad

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Abstract
The present work was carried out to determine the influence of lactation rank on the milk yield, fat and protein evolution. Observations were carried out on 117 lactations, as follows: 15 first lactations, 22 second lactations, 26 third lactations, 28 fourth and 26 fifth lactations. It was found out that the average milk yield was 7511.66 kg with the maximum in the fifth lactation (7898.19 kg) and the minimum of 7117.06 kg in first lactation. The differences were highly significant until the third lactation. After the fourth lactation the differences between lactations become statistically no significant, as productive maturity is reached. Milk fat percentage reaches the maximum value in the fifth lactation (4%) with a minimum value recorded in the fourth lactation (3.83%). The average milk fat percentage was 3.94%. Significant and very significant differences occurred for the milk fat percentage between the first three lactations and the fourth and fifth lactations. Milk protein percentage has averaged 3.2%. This parameter is less influenced by lactation rank.

Keywords: Brown Swiss, fat percentage, lactation rank, milk yield, protein percentage, sire dam.

1. Introducere

Milk represents a physiological secretion of the mammary gland, being considered as the perfect food due to its fat, protein, vitamin and minerals content [1]. Each of milk components has an essential role in development and maintaining the health status of the organism [2]. Not the least, the fat and protein milk content have an influence on the milk price. Chemical composition, though, is influenced by several internal and external factors, such as lactation order, feeding level of cows, diet composition, genetic potential of cows, breed type [3].

2. Materials and methods

The study was carried out in the cattle farm of the Research and Development Station for Bovine Raising - Arad. A number of 117 lactations obtained from Brown cows (Brown Swiss type) were studied, divided according to the lactation order, as follows: 15 first lactations, 22 second lactations, 26 third lactations, 28 fourth lactations, and 26 fifth lactations.
The following traits were studied: milk yield, fat percentage and protein percentage
Data were statistically processed, computing the averages, standard deviation and variability. Differences between the averages were tested using t test.

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3. Results and discussion

Studying the evolution of the three traits: milk yield, fat percentage and protein percentage, it was easily observed the ascending trend from lactation to lactation.

Table 1 presents the averages and dispersion indices for milk yield. Milk yield in the first lactation was 7117.00 kg, significantly increasing to the maximum production in the fifth lactation of 7898.19 kg. Milk yield in the first lactation represents 90% from the maximum yield. Thus, we can state that milk yield statistically increase from lactation to lactation up to the fourth lactation, then the increase is less. This evolution is explained by the fact that production maturity is reached in the fifth lactation.

Table 1 Milk yield evolution and dispersion indices according to the lactation order

Lactation	n	x	SD	V%
1	15	7117.06	165.01	8.98
2	22	7460.00	199.03	12.51
3	26	7237.07	153.19	10.79
4	28	7846.00	200.50	13.52
5	26	7898.19	236.57	15.27
Total	117	7511.65	190.86	12.21

Differences for milk yield and their statistical significance are presented in Table 2. As it was mentioned previously, differences for milk yield among lactations were highly significant ($p<0.001$), except for the difference of 120.01 between lactation 1 and 3 that was significant ($p<0.05$) and for the difference of 52.19 kg between lactation 4 and 5 that was non-significant ($p>0.05$).

Table 2 Differences and statistical significance for milk yield according to lactation order

Lactation	5	4	3	2
1	781.12***	-728.93***	-120.01*	-342.93***
2	-438.19***	-386***	222.92***	-
3	-661.11***	-608.92***	-	-
4	-52.19^{ns}	-	-	-

The general trend of milk fat percentage was to increase with lactation order (Table 3), the lowest values being 3.89% in the third lactation and 3.90% in the first lactation, while the highest values was obtained in the fifth lactation, 4.00%.

Variability for this trait was low, variability coefficients varying from 5.92% in the first lactation to 15.9% in the fifth lactation

Table 3 Milk fat percentage evolution and dispersion indices according to lactation order

Lactation	n	x	SD	V%
1	15	3.90	0.06	5.92
2	22	3.93	0.07	8.04
3	26	3.89	0.06	7.93
4	28	3.98	0.21	8.56
5	26	4.00	0.12	15.9
Total	117	3.94	0.10	9.27

From Table 4, it could be seen that there was no statistical significance between the average values for milk fat percentage of the first lactation and the second and third lactations, as well as between the milk fat percentage of the fourth and fifth lactation.Clearly the milk fat percentage in the fourth and fifth lactations were significantly higher than fat percentage in the first, second and third lactation.

Table 4 Differences and statistical significance for milk fat percentage according to lactation order

Lactation	5	4	3	2
1	-0.10***	-0.08*	0.01^{ns}	-0.03^{ns}
2	-0.07**	-0.05***	0.04*	-
3	-0.11***	-0.09***	-	-
4	0.02^{ns}	-	-	-

Milk protein percentage is not varying too much according to lactation order (Table 5). The lowest value is observed in the first lactation (3.18%) and the highest value of 3.21% is observed in lactation 3 and 5.

Table 5 Milk protein percentage evolution and dispersion indices according to lactation order

Lactation	n	x	SD	V%
1	15	3.18	0.02	2.52
2	22	3.20	0.02	2.59
3	26	3.21	0.02	3.42
4	28	3.20	0.02	3.29
5	26	3.21	0.03	5.27
Total	117	3.20	0.02	3.41

Statistically there were less significant differences across the lactations for milk protein percentage (Table 6). Milk protein percentage in the first lactation was significantly lower than the same trait in all other lactations. Therefore, we could state that starting the second lactation there is no significant increase in milk protein percentage.

Table 6 Differences and statistical significance for milk protein percentage according to lactation order

Lactation	5	4	3	2
1	-0.03***	-0.02**	-0.03***	-0.02**
2	-0.01^{ns}	0.003^{ns}	0.01^{ns}	-
3	0.01^{ns}	0.007^{ns}	-	-
4	0.007^{ns}	-	-	-

4. Conclusions

- Milk yield has the lowest value in the first lactation, being 90% from the maximum production observed in the fourth lactation. After the maximum lactation differences between lactations are reduced. This evolution from lactation to lactation could be explained by the fact that Brown breed has a higher production in the first lactation compared to the maximum lactation.
- Milk fat percentage increased with lactation. The lowest value was observed in the first lactation, 3.9%, while the highest was in the fifth lactation (4.00%).
- Milk protein percentage varied very little from lactation to lactation. The lowest milk protein percentage was observed in the first lactation, being 3.18%. The highest value of 3.21 was obtained in lactations 3 and 5. The only significant difference was observed between the first lactation and all other lactations.

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