

Lactation Order Effects on Milk Production in Romanian Black and White Cows from Timiș County

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Abstract

Researches were carried out on 988 normal lactations of Romanian Black and White cows from the actual active population raised in Timiș County. Six groups of production were formed according to the lactation order: 1st, 2nd, 3rd, 4th, 5th, and 6th and over. For each group, the averages and dispersion indices were calculated, and the differences between groups were statistically tested. The highest production was obtained by cows in the 6+ lactation, 4979.2 kg milk with 3.921% fat and 3.26% protein, and the lowest in the first lactation 4455.4 kg milk with 3.944% butterfat and 3.195% protein. Milk production in the first lactation was significantly lower ($p < 0.05$) than that produced by cows in the second, fifth and sixth lactations, by 495.9 kg milk and 16.98 kg protein; 477.9 kg milk and 17 kg protein; and 523.8 kg milk and 19.97 kg protein, respectively. Also, cows in the second lactation produced more ($p < 0.05$) by 353.8 kg milk and 10.61 kg butterfat than cows in the third lactation.

Keywords: cows, lactation, milk, Romanian Black and White, Timiș

1. Introduction

Milk production, quantitatively and qualitatively, is the result of the functional activity of the whole organism, being influenced by several factors that act directly or indirectly on the animal organism [1].

Lactation order is correlated with age of cows, with milk production during the lifetime varying lactation to lactation. Usually, the milk production per lactation increases with age, up to a maximum level, then is starting to decrease as animals get older. Causes that produce this variation in milk production are multiple, in most cases metabolism intensity, udder volume and structure and the digestive tract capacity being the main reasons. Because of the changes in these factors the highest milk production increase is seen from the first to

the second lactation. Milk production decrease after the maximum level occur due to ageing phenomenon, reduction of the intensity of vital functions, reduction of the intake and digestion capacity, and reduction of the recovery of mammary alveoli during the dry period [2].

Breed precocity and genetic improvement is responsible for the age or lactation order that the cows are producing the maximum milk yield. It is very common for Holstein-Friesian cows to produce the maximum milk yield at the 3rd or 4th lactation, and in the first lactation to produce 75-80% of the maximum lactation.

Economically it is good that cows will produce the maximum production at a younger age and maintain this level a longer time, and in the first lactation to produce as high as possible in respect with the maximum production.

Generally, butterfat production is decreasing from first lactation to the maximum level by 0.2-0.3 percentage points, while total dry matter by 0.4-0.5 percentage points.

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The objective of this paper was to investigate the influence of the lactation order on the milk production in Romanian Black and White cows raised in Timiș County, Romania.

2. Materials and methods

The study was carried out on 988 normal lactations of Romanian Black and White cows (Holstein-Friesian type) bred in Timiș County. Data was collected from the official performance control system, only from actual active population. Lactations started between January 2000 and December 2007. The lactations were divided into six groups according to the lactation order, thus 1st (n=389), 2nd (n=279), 3rd (n=183), 4th (n=70), 5th (n=36), and 6th and over (n=31). For each age group, the averages and dispersion indices were calculated. Differences among averages were tested for significance using ANOVA/MANOVA in Statistica Statsoft.

3. Results and discussion

Table 1 presents the milk production per normal lactation according to lactation order. On average, the actual population of Romanian Black and White cows produced 4676.4 kg milk.

Primiparous cows produced, on average, 4455.4 kg milk per normal lactation. On the second lactation, Romanian Black and white cows produced 4951.3 kg milk per lactation. The increase of 495.9 kg from first to the second lactation (11%) was statistically significant ($p < 0.001$).

Table 1. Average milk yield (kg) per normal lactation in Romanian Black and White cows

Lactation	n	X±SEM	SD	v%
1	389	4455.4±69.95 ^a	1379.64	30.97
2	279	4951.3±109.78 ^{ab}	1833.69	37.03
3	183	4597.5±120.80 ^{bc}	1634.21	35.55
4	70	4748.6±210.79 ^d	1763.59	37.14
5	36	4933.3±336.72 ^{ac}	2020.32	40.95
6+	31	4979.2±368.07 ^{af}	2049.34	41.16
Total	988	4676.4±52.52	1650.76	35.30

Averages with the same superscript letter differ significantly at $p < 0.05$

In the third lactation, the milk production was lower than in the second lactation by 353.8 kg milk (4597.5 kg). Again, this decrease of milk production in the third lactation (7.7%) was significant ($p < 0.01$). After the third lactation the

production continued to increase up the sixth or later lactations. The highest milk production per normal lactation was obtained from the cows in the sixth or later lactation, being 4979.2 kg milk. This production was 11.8% significantly higher than that of primiparous cows (523.8 kg, $p < 0.05$) Milk production of 4933.3 kg produced by cows in the fifth lactation was, also, 10.7% higher than milk production of primiparous cows.

Differences among other lactation did not reached the significance level ($p > 0.05$).

Variability within the groups was average, tending to be high, variability coefficient varying from 30.97% to 41.16%. It could be observed that as lactation increased, the number of individuals per groups became lower and variability increased.

This pattern of milk production evolution (Figure 1) according to the lactation order is not sustained by the literature which state that milk production should increase up to a maximum level and then decrease as cows get older. This is probably because the conditions of feeding and housing of cows, which were not always proper.

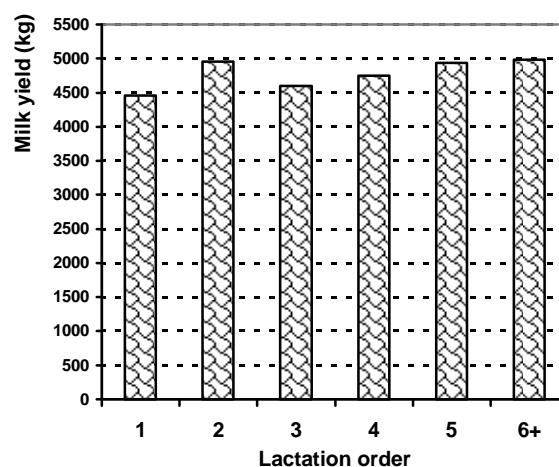


Figure 1. Milk yield in Romanian Black and white according to the lactation order

Table 2 presents the average butterfat production of cows. The average butterfat production of the studied population was 183.83 kg with an average percentage of 3.924%.

The evolution of the butterfat yield from lactation to lactation was somehow similar to that of milk yield. Thus, the lowest butterfat yield was produced by primiparous cows (176.29 kg), and the highest by cows in the sixth lactation (195.31 kg). The butterfat yield was 193.94 kg in the second lactation, which abruptly decreased to

179.74 kg in the third lactation. After that, the butterfat yield continued to increase up the maximum level in the sixth and over lactations. Variability was similar to that of milk yield, variability coefficient varying from 32.73% to 41.59%.

Although the differences among groups according the lactation order were quite high (up to 11%), no significance was detected, probably because of high variability within groups.

The butterfat percentage was the highest in primiparous cows (3.944%), decreasing to 3.905% in the third lactation, and then increasing slightly until the sixth and later lactations (3.921%). The variability within groups was low, variability coefficient varying between 3.08% and 9.80%.

The highest difference between groups in butterfat percentage was 1%, leading to the result that no statistical significance was detected among groups ($p>0.05$). However, the trend of butterfat percentage across the lactation order was complying with literature data, being higher at the beginning of productive life and then decreasing up to a point, and increasing again until the end of productive life of cows.

Average milk protein production per cow per normal lactation, according to lactation order, is presented in Table 3. On average, cows belonging to the studied Romanian Black and White population produced 150.46 kg milk protein, and had a milk protein content of 3.224%.

Table 2. Average butterfat production in Romanian Black and White cows

Lactation	n	Butterfat yield (kg)			Butterfat percentage (%)		
		X±SEM	SD	v%	X±SEM	SD	v%
1	389	176.29± 2.925 ^a	57.693	32.73	3.944±0.0196 ^a	0.3866	9.80
2	279	193.94± 4.437 ^b	74.117	38.22	3.914±0.0103 ^b	0.1719	4.39
3	183	179.74± 4.869 ^c	65.873	36.65	3.905±0.0118 ^c	0.1600	4.10
4	70	186.36± 8.567 ^d	71.675	38.46	3.915±0.0248 ^d	0.2072	5.29
5	36	192.98±13.375 ^{ae}	80.250	41.59	3.910±0.0264 ^e	0.1582	4.04
6+	31	195.31±14.379 ^f	80.059	40.99	3.921±0.0217 ^f	0.1208	3.08
Total	988	183.83±2.134	67.084	36.49	3.924±0.0088	0.2764	7.04

Averages with the same superscript letter differ significantly at $p<0.05$

Table 3. Average milk protein production in Romanian Black and White cows

Lactation	n	Protein yield (kg)			Protein percentage (%)		
		X±SEM	SD	v%	X±SEM	SD	v%
1	389	142.45± 2.412 ^a	47.454	33.31	3.195±0.0115 ^a	0.2253	7.05
2	279	159.43± 3.476 ^{ab}	57.950	36.35	3.235±0.0127 ^b	0.2110	6.52
3	183	148.82± 3.817 ^{bc}	51.498	34.60	3.256±0.0088 ^c	0.1189	3.65
4	70	153.50± 6.939 ^d	58.056	37.82	3.230±0.0187 ^d	0.1562	4.84
5	36	159.45±10.903 ^e	65.417	41.03	3.231±0.0159 ^e	0.0952	2.95
6+	31	162.42±12.159 ^{af}	67.701	41.68	3.260±0.0140 ^f	0.0780	2.39
Total	988	150.46± 1.718	53.892	35.82	3.224±0.0085	0.2652	8.23

Averages with the same superscript letter differ significantly at $p<0.05$

Milk yield evolution according to the lactation order followed the same pattern as shown in milk yield and butterfat yield. This means that the lowest milk protein yield was produced by the primiparous cows (14.45 kg). The milk protein yield increased to 159.43 kg in the second lactation, which was approximately the same level as milk protein yield produced in the fifth lactation (159.45 kg). After the second lactation increase in milk protein yield, in the third lactation a decrease of this parameter was observed, to 148.82 kg. The highest milk protein yield was obtained from cows being in the sixth or higher

lactation. Variability for this trait was medium to high, variability coefficient varying between 33.31% and 41.68%.

Milk protein yield produced in the first lactation was 14% (19.97 kg) higher than that produced in the sixth or higher lactation ($p<0.05$). Also, the primiparous cows produced about 12% ($p<0.05$) less milk protein yield than cows in the second and fifth lactations (by 16.98 kg and 17.00 kg, respectively). Also, the drop of 7% (10.61 kg) in milk protein yield of cows in the third lactation compared to those in the second lactation was statistically significant ($p<0.05$).

The milk protein percentage (Table 3) increased from the first lactation (3.195%) to the third lactation (3.256%), then decreased again in the fourth and fifth lactations (3.230% and 3.231%, respectively) and was high again in the sixth or later lactations (3.260%). Variability within age groups was low, variability coefficient varying from 2.39% to 7.05%.

The maximum range between the lowest value (3.195% in first lactation) and the highest value (3.26% in the sixth lactation) for milk protein content was low (only 2%), thus the differences among age groups were not statistically significant ($p > 0.05$).

4. Conclusions

Romanian Black and White cows from Timiș County produced, on average, per normal lactation 4676.4 kg milk with 3.924% butterfat and 3.224% milk protein.

Primiparous cows had the lowest milk production (4455.4 kg milk), the highest butterfat content (3.944%), and the lowest milk protein content (3.915%).

The highest milk yield was produced by cows in the sixth or higher lactation (4979.2 kg), having also the highest milk protein percentage (3.26%).

The lowest butterfat percentage was observed in the third lactation cows.

Lactation order had a significant influence on the milk yield and protein yield. Butterfat yield and butterfat and protein contents were not affected by the lactation order.

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