

THE EFFICIENCY OF NUTRIENT UTILIZATION IN THE WINTER AND SUMMER FEEDING PERIODS IN DAIRY COWS DURING THE FIRST THREE LACTATIONS

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*The utilization of basic nutrients was investigated in dairy cows according to lactation. The study lasted for 14 weeks and included 25 black and white-Holstein crossbred cows. The first 7 weeks of lactation coincided with the winter feeding scheme and the other 7 with the summer scheme. Cows produced significantly less milk (4%FCM) in first lactation than in second and third ( $P<0.01$ ). The efficiency of dry matter utilization per kg of 4% FCM was significantly lower in the first lactation ( $P<0.01$ ) compared with second and third. The utilization of dry matter and energy was similar in both feeding periods, but for digestible crude protein it was significantly higher ( $P<0.01$ ) in the later period.*

*Key words: cow feeding, 4%FCM, energy, protein, dry matter.*

INTRODUCTION

The achievement of genetic capacities for high milk production in cows largely depends on feeding. The basis of this problem is how to provide animals with appropriate amounts of nutrients in all phases of their productive cycle. For high milk production the first weeks of lactation are the most important (Van Soest 1987, Kertz et al., 1991; Chase and Sniffen 1992; Barmore 1993; Watiaux 1994).

While formulating and balancing the diets it is important to consider many factors, including: level of feeding, concentration of the diet including the relationship between roughage and concentrate feeds, type and quality of feeds used, the influence of nutrients on milk yield and composition (Zeremski,

1987, Latinović et al. 1987, Grubić and Adamović, 1998. Mansfield et al. 1990. May et al. 1990).

The aim of this work was to investigate the influence of lactation number on the utilization of nutrients in the first third of lactation in cows kept under production conditions.

#### MATERIAL AND METHODS

The feeding trial was performed on a farm that is a part of the Belgrade Agricultural Corporation (PKB). Milk production was observed during the first 14 weeks of lactation for 25 animals from the population of black and white crossbred Holstein cows. All animals received the same diets (Table 1 and 2), namely the winter scheme for the first 7 weeks and summer scheme for the other 7 weeks. An adjustment period (14 days) was allowed when the diets were changed over.

Table 1. Daily diets for cows in the winter and summer period

Feeds	Winter period (1-7 weeks) kg	Summer period (8-14 weeks) kg
Green forage mixture	—	25.0
Lucerne hay	2.0	2.0
Lucerne haylage	6.0	6.0
Maize plant silage	25.0	15.0
Dried sugar beet pulp	2.0	2.0
Maize ear silage	4.0	0.0
Soybean cake	2.0	2.0
Concentrate mixture (21% TP)	0.0	5.0
Concentrate mixture (32% TP)	4.4	—
Nutritional parameters		
Dry matter, kg	21.1	19.3
Net energy for lactation (NEL), MJ	142.3	129.2
Total protein (TP), g	3060	3770
Crude fibre, g	4040	3396
Forage feeds, %	70.0	78.0
Concentrate feeds, %	30.0	22.0

The food intake was recorded daily. There were 10 animals in the first lactation, 7 in the second and 8 in the third, namely three experimental treatments with distribution of units according to randomized plan. The comparison was performed by analysis of variance and the Fisher (F) test.

The chemical composition of the feeds was determined by (Weende) methodology and net energy was calculated according to Obračević (1990).

Table 2. Concentrate mixture composition (%)

Feed	21% TP	32% TP
Maize meal	45.2	–
Barley meal	–	6.0
Sunflower meal	34.8	53.5
Rapeseed meal	–	15.0
Wheat middlings	15.0	–
Minerals + premix	5.0	8
Nutritional parameters		
Total protein (TP), %	21	32
NEL, MJ	6.3	6.2

## RESULTS AND DISCUSSION

The milk production (expressed as 4%FCM) is shown in Figure 1. The milk yield had a conclusive pattern with animals in all three groups. It is obvious that production in the first lactation did not reach the level of the other two. The differences between treatments were statistically significant ( $P < 0.05$ ). This

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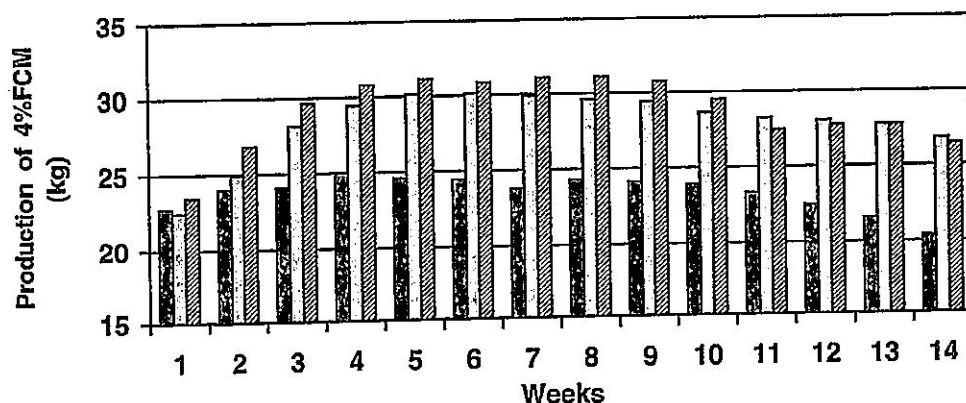


Figure 1. Production of 4% FCM during the experiment

trend was noticeable also in other investigations that were performed on PKB farms (Romčević et al., 1993).

Table 3. Dry matter utilization per kg 4%FCM(kg)

Lactation	Winter period – weeks						
	1	2	3	4	5	6	7
1	0.88	0.84	0.84	0.81	0.82	0.83	0.85
2	0.90	0.81	0.72	0.69	0.67	0.67	0.67
3	0.86	0.75	0.68	0.65	0.65	0.65	0.65
Lactation	Summer period – weeks						
	8	9	10	11	12	13	14
1	0.89	0.90	0.90	0.93	0.96	1.00	1.06
2	0.73	0.73	0.75	0.76	0.77	0.78	0.81
3	0.69	0.70	0.73	0.79	0.78	0.78	0.82

The efficiency of dry matter utilization is shown in table 3. From the data it is noticeable that dry matter utilization was constantly higher with animals in the first lactation in comparison with the second and third. The differences were statistically highly significant ( $P < 0.01$ ), which agrees with results from other investigations. With animals of similar performance (18,2 kg 4%FCM). May et al. (1990) found dry matter utilization between 0.75 and 0.88 kg/kg 4% FCM. More productive animals (33.5 kg 4% FCM) showed better utilization per kg 4% FCM, from 0.64 to 0.70 (Mansfield et al., 1990). From the aspects of feeding season - lactational stage the utilization of dry matter was similar ( $P > 0.05$ ).

Table 4. Energy utilization per kg 4%FCM (MJ NEL)

Lactation	Winter period – weeks						
	1	2	3	4	5	6	7
1	7.75	7.38	7.35	7.15	7.21	7.26	7.44
2	7.87	7.11	6.29	6.03	5.87	5.87	5.91
3	7.55	6.61	5.99	5.75	5.68	5.73	5.68
Lactation	Summer period – weeks						
	8	9	10	11	12	13	14
1	6.51	6.56	6.61	6.78	7.04	7.32	7.73
2	5.35	5.38	5.52	5.60	5.64	5.69	5.90
3	5.07	5.13	5.36	5.77	5.71	5.69	5.98

The same tendency appeared for energy utilization per kilogram of milk produced (Table 4). The differences between animals in the first lactation on one side, and second and third on the other were statistically, highly significant ( $P < 0.01$ ). It should be noted that during the early lactation in the winter feeding

period the utilization of energy per kg of 4%FCM was slightly higher, which was expected considering the weather conditions (temperature).

Protein utilization per kilogram of milk produced is shown in table 5. The differences were statistically significant ( $P < 0.01$ ). The utilization of protein was significantly lower in winter than in summer. This is the consequence of excess quantities of protein that animals consume while being feed with fresh forage. Zeremski and Mitrović (1965), and Zeremski and Vuković (1966) found notably higher protein utilization per kg of 4% FCM. It should be added that, as a rule, more concentrate is used than is really necessary on our larger dairy farms (Trifunović et al. 1993, Grubić et al. 1996).

There may be several reasons for the described tendency in nutrient utilization, but the main one is that cows in the first lactation have not frished growth completely. In those animals part of the nutrients was used for growth. Also their body reserves were smaller, which is very important during the first few weeks of lactation (Grubić et al. 1989). The result of all this was the smaller milk production.

Table 5. Total protein utilization per kg 4%FCM (g)

Lactation	Winter period – weeks						
	1	2	3	4	5	6	7
1	126	120	120	116	117	118	121
2	128	116	102	98	96	96	96
3	123	107	97	94	92	93	92
Lactation	Summer period – weeks						
	8	9	10	11	12	13	14
1	167	168	170	174	180	188	198
2	137	138	142	143	144	146	151
3	130	132	137	148	146	146	153

#### CONCLUSION

Fromm the conducted investigation it is possible to draw the following conclusions:

- cows in the first lactation produce significantly less milk (4%FCM) than in the second and third lactation ( $P < 0.01$ ).
- the utilization of dry matter, energy and digestible protein per kilogram of 4%FCM produced was higher ( $P < 0.01$ ) with animals in the first than in the second and third lactation;

- the dominant reason for this trend is that animals in the first lactation use a part of their nutrients for growth.

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## UTROŠAK HRANLJIVIH MATERIJA U ZIMSKOM I LETNJEM PERIODU ISHRANE KOD MLEČNIH KRAVA U PRVE TRI LAKTACIJE

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### SADRŽAJ

U ovom radu ispitivan je utrošak osnovnih hranljivih materija u ishrani muznih krava posmatrano po laktacijama. Ispitivanja su izvedena u proizvodnim uslovima, a ukupno je bilo obuhvaćeno 25 grla crno-bele rase oplemenjenih genima holštajna. Period istraživanja je trajao 14 nedelja. Prvih 7 nedelja obuhvatio je zimski period ishrane a drugih 7 letnji. U prvoj laktaciji krave su proizvele signifikantno više mleka (4%MKM) nego u drugoj i trećoj ( $P<0.01$ ). Utrošak suve materije, energije i svarljivih sirovih proteina za kilogram proizvedenog 4% MKM bio je znatno veći ( $P<0.01$ ) kod grla u prvoj lokaciji nego u drugoj i trećoj. Utrošci suve materije i energije po kilogramu 4% MKM, posmatrano po periodima ishrane bili su slični, za razliku od svarljivih sirovih proteina čiji je utrošak u letnjem periodu bio značajno ( $P<0.01$ ) veći.