Original scientific paper - Izvorni znanstveni rad UDK: 636.2/637.12

Effect of concentrate exchange on dairy farm

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Received - Prispjelo: 01.07.2008.
Accepted - Prihvaćeno: 05.02.2009.

Summary

The purpose of the research was to establish the effect of concentrates A (C-A) and B (C-B) on the quantity and composition of the produced milk of dairy cows. The research included cows of Holstein Friesian and Simmental breeds and crossbreeds with Simmental breed. The test took place in two periods. The first period with the C-A lasted from December 2004 to February 2005 and included 113 cows. During the second period the C-B was fed. The test endured from April to June 2005. The results of monthly controls of milk quantity and protein and fat contents were entered into the Excel programme and processed with the statistical programme SPSS for Windows 12.0. When the concentrate B was fed, the milk quantity amounted to 21.99 L/day and was statistically significantly ($P<0.05$) greater than the milk quantity in case of feeding the concentrate A, when the milk quantity was 19.12 L/day. No statistically significant differences ($P<0.05$) of the protein and fat content in the milk were established.

Key words: milking cows, concentrate, milk quantity, proteins, fats

Introduction

The milk production in the Slovene agriculture continues to be one of the important agricultural specializations. In addition to the genetic potential the milk quantity and composition are largely influenced by the feed given to dairy cows. The high demand for nutritive substances requires additional feeding of concentrates in addition to the basic ration from voluminous feed. The animals can receive the concentrates in the manger or on the feed table, in the milking parlour or in computer controlled feeding stations in barns with free housing system of raising (Janžekovič, 2003). It is the concentrate that, in combination with high-quality basic feed, allows making full use of the animals' genetic potential. It must be pointed out that the milk industry needs more and more raw milk with higher milk protein content.

Milk production and composition is mostly influence by changes of consumption of the dry substance from the whole ratio. We have to count on voluminous part, total consumption of the dry substance of the ration, rate and degree of digestibility of organic matter and not the last also the addition of concentrate. Also in case of *ad libitum* feeding a very different degree of satisfying the needs can be reached with the voluminous feed, expressed with the milk quantity ensured by the voluminous feed. In extreme cases that quantity varies between 0 to 18 litres and more, but usually the variation is from 5 to 15 litres. If with ad-lib feeding the basic ration ensures a higher milk production, there is also a higher effect of the concentrate for milk production above the quantity obtained from the basic ration.

Gruber (2007) states that with increased consumption of concentrate the consumption of the basic feed is reduced within 0.51 kg of dry substance per kg of dry substance of the concentrate. On the one hand, the decreased consumption of the basic feed can be caused by increased production of the acid during fermentation of carbon hydrates of the concentrate and, on the other hand, by the reduction of structural fibres in the ration and microorganisms in the intestines. Analogously to consumption of the basic feed also the milk production was decreased, namely for 0.93 kg FCM. On the basis of the increase of the energy value for 5.17 MJ NEL, resulting from 1 kg of the dry substance of concentrate, the increase of milk production for 1.63 kg can be theoretically derived. The increase of the milk production is influenced also by the time of consumption of the concentrate, the average of the increase being 0.90 kg of milk and/or 0.95 FCM.

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Table 1: Number of cows (n) of the individual breed included in the test
Tablica 1: Broj krava (n) po pasminama uključenih u test

Breed Pasmina	1st period 1. razdoblje	2nd period 2. razdoblje
Holstein Friesian - HF Holštajnsko-frizijska - HF	49	42
Simmental - SI Simentalac - SI	44	46
Crossbreeds - CB Križanci - KR	20	17
In total Ukupno	113	105

Table 2: Quantities of basic feed added to feed ration during the test period
Tablica 2: Količine osnovne krme dodane u krmni obrok u pokusnom razdoblju

Feed Krma	1st period 1. razdoblje	2nd period 2. razdoblje
Hay (kg) Sijeno (kg)	1.6	1.5
Grass silage (kg) Travna silaža (kg)	10.7	15.0
Maize silage (kg) Kukuruzna silaža (kg)	24.0	22.0

The milk production during the tests was controlled according to the AT4 method. This method is considered to be the standard reference method of ICAR. The control of milk production must be affected in accordance with the stipulations of the approved breeders' programme. The purpose of execution of milk production control is to measure the milked quantity of milk during the individual milking and to take representative milk sample without the characteristic influences on the milking and milk quality during the time of execution of the control. The control is affected on farms, where the milking cows are raised in the known and recognized manner. All milking cows in the herd must be included in testing irrespective of the produced milk, breed or any other criterion. The control of milk production according to the AT4 method is executed by a competent person of the authorized breeders' organization. The milk control is executed alternating, one month at the evening milking (PM), the next month at the morning milking (AM) on all milking cows being in lactation at the time of the control. The milk quantity must be measured and recorded within 0.2 kg accuracy (recommended accuracy 0.1 kg). The control is executed once a month. Allowable interval between two controls in the same herd is 22 to 37 days. Annually, at least 11 controls in any controlled herd must be performed. The milk yield record upon the control must contain the actually measured quantity of milk in kilograms in case of individual milking. The milk composition based on the samples taken upon the individual milking (content of milk fat, proteins...) is automatically transferred from the laboratory to the central data base (Čepon et al., 2006).

The milk industry and the consumers are increasingly interested in the total content of the dry substance in the milk and/or at least fat dry substance. Caput (1996) state that, as far as the preparation of the ration is concerned, interdependences exist between cows, available feed and milk price. On the part of the cow such influence is the body mass and its changing, the milk yield, the stage of lactation and appetite. The influencing factor of the feed is the digestibility, the unit price of the metabolic energy (ME) and digestible crude proteins (DCP), and the balance between dry matter, ME, DCP, fiber etc.

The purpose of the research was to establish the effect of concentrates A and B, whose compositions differ, on the amount and composition of the milk produced by cows on specialized farms.

Materials and methods

The test took place on the farm specialized in milk production. In the first test period, when the concentrate A was fed, 113 cows were included in the test. This period lasted from 01.12.2004 to 28.02.2005. March 2005 represented a transition period, when the animals accustomed themselves to new concentrate. The second test period endured from 01.04.2005 to 30.06.2005. During this period the concentrate B was fed to the cows; 105 cows were

Table 3: Quantities of added concentrated feed during the test period depending on the quantity of the milk yield
Tablica 3: Količine dodane krmne smjese u pokusnom razdoblju u ovisnosti o količini namuzenog mlijeka

Concentrated feed/milk quantity (L) Krepka krmiva/količina mlijeka (L)	21	24	28	34	40
1st test period / 1. pokusno razdoblje					
Maize meal (kg) Kukuruzno brašno (kg)	1.5	2.0	2.0	2.0	2.0
Sunflower meal (kg) Suncokretova sačma(kg)	2.0	2.0	2.0	2.0	2.0
Soya bean meal (kg) Sojina sačma (kg)	1.0	1.0	1.0	1.0	1.0
Concentrate A (kg) Krmna smjesa A (kg)	-	0.5	1.0	5.0	8.0
2nd test period / 2. pokusno razdoblje					
Maize meal (kg) Kukuruzno brašno (kg)	1.5	2.0	2.5	2.5	2.5
Sunflower meal (kg) Suncokretova sačma(kg)	1.5	1.5	1.5	1.5	1.5
Soya bean meal (kg) Sojina sačma (kg)	1.0	1.0	1.0	1.0	1.0
Concentrate B (kg) Krmna smjesa B (kg)	-	1.0	2.0	6.0	8.0

included in the test. Table 1 shows the number of cows of the individual breed included in the test during the individual period.

The basic ration (hay, grass silage and maize silage) was identical in both tests. The difference was only in the quantity of the added concentrated feed. The feed analyses were made for the basic feed which was identical during both periods (used from the same silo since on the farm only one ration is fed throughout the whole year). Table 2 shows the quantities of the individual voluminous feed added to the feed ration.

Table 3 shows the quantities of added concentrated feed during the test period.

The above results of the milk production control on the farm have been adopted from the report on the results of the average milk production control in the herd, issued by the Cattle-breeding department of the Slovene Agricultural Institute and have been based on the milk production control affected during the tests.

The milking cows of the Simmental and Holstein Friesian breeds and the crossbreeds with the Simmental breed were included in the research. By processing of monthly data on the milk yield the effect of the added concentrates on the produced milk quantity and composition was established for periods from December 2004 to February 2005 and from April to June 2005. Three most important parameters which are considered in the payment of milk were in the focus. The milk composition analyses were performed with Milco-Scan (Foss Electric), somatic cells were determinate with Somacount 300 in diagnostic center Veterinary and animal Husbandry Department, Ptuj.

On the basis of composition of the concentrate B it was assumed that the quantity of the produced milk in the herd would be higher than in case of feeding the concentrate A. It was also supposed that the fat and protein contents in the produced milk would increase. The obtained data on the milk quantity and composition were entered into the Excel for Windows and processed with the statistical programme SPSS for Windows 12.0. By the analysis of variance the influence of the feed, breed, lactation and number of days in lactation on the milk quantity and the protein and fat content in the milk was studied. The differences which were statistically significant in the least significant difference (LSD) test were marked with $P<0.05$.

Results and discussion

The research was meant to establish whether switching to feeding the other concentrate (C-B) would be appropriate to ensure higher milk production, higher content of nutritive substances in the milk and less losses in the herd.

Table 4: Analysis results for grass and maize silage, concentrates A and B per kg dry matter (g/kg DM)
Tablica 4: Rezultati analiza travne silaže, kukuruzne silaže, krmnih smjesa A i B na kg suhe tvari (g/kg ST)

Parameter Parametar	g.s. t.s.	m.s k.s.	C-A KS-A	C-B KS-B
Crude proteins (f=6.25) Sirovi proteini (f=6.25)	150.7	56.9	217.1	231.5
Crude fibre Sirova vlakna	299.7	237.0	74.7	60.1
Crude fat Sirova mast	58.1	16.3	27.8	57.8
Crude ashes Sirovi pepeo	208.4	53.4	68.0	36.1
Nitrogen-free extract Nedušične ekstraktivne tvari	289.1	636.4	606.7	614.3
Digestible crude proteins Probavljivi sirovi proteini	69.2	30.4	192.0	184.5
Starch units Škrobne jedinice	492.7	589.6	771.4	842.1
Net energy of lactation (MJ/kg DM) Neto energija laktacije (MJ/kg ST)	5.48	6.34	8.0	8.4
Calcium Kalcij	4.50	7.93	10.8	4.0
Phosphorus Fosfor	4.13	1.74	6.3	5.6

Legend: g.s.- grass silage, m.s.- maize silage; C-A - concentrate A, C-B - concentrate B
Legenda: t.s. - travna silaža, k.s. - kukuruzna silaža, KS-A - krmna smjesa A, KS-B - krmna smjesa B

Results of ration analysis

Table 4 shows the results of the Weende analysis for the grass and maize silage and concentrates A and B.

On the basis of the results of the Weende analysis of feed the ration for the dairy cows was composed. The basic ration was composed of voluminous feed and was identical in both test periods. It consisted of hay, grass silage and maize silage (see table 2). The basic ration was completed still with concentrates to complement the content of nutritive substances of the basic ration. The quantity of the added concentrated feed is shown in table 3.

Table 4 shows that there is a certain deviation between the added concentrates A and B. Where the concentrate B contains higher amount of crude fiber, crude fat, nitrogen-free extract, net energy of lactation and digestible proteins were lower than comparable concentrate. Also the control of consumption was important. Greater and better appetite in consumption of the concentrate B was noticed.

Table 5 shows the recommended ration for milking cows of the concentrate B.

Table 5: Recommended ration for milking cows with the use of concentrate B
Tablica 5: Preporučeni krmni obrok za krave muzare s uključenom krmnom smjesom B

Feed (kg) Krmivo (kg)	Daily milk yield (L) / Mlijeka na dan (L)				
	20	25	30	35	40
Grass silage (33 % DM) Travna silaža (33 % ST)	10.0	10.0	10.0	10.0	10.0
Maize silage (33 % DM) Kukuruzna silaža (33 % ST)	28.0	28.0	28.0	28.0	28.0
Straw Slama	0.5	0.5	0.5	0.5	0.5
Concentrate B Krmna smjesa B	3.0	5.0	5.0	5.0	5.0
Premix / Concentrate Premiks / Smjesa	0.20	0.25	0.30	0.35	0.40

Table 6: Number of cows included in the tests during the individual period, average daily milk quantity per cow and standard error
Tablica 6: Broj krava muzara u pokusu u pojedinom razdoblju, prosječna dnevna mliječnost po kravi i standardna greška

	Feed Krma	n	$\overline{x}$ ±SD	SEM
Milk (L) Mlijeko (L)	C-A	113	19.13±7.50	0.71
	C-B	105	21.99*±7.75	0.76

Legend:* statistically significant difference (P<0.05), SD - standard deviation, SEM - standard error of mean
Legenda: * statistički signifikantna razlika (P<0,05), SD - standardna devijacija, SEM - standardna greška

Table 7: Influence of added concentrate, month of feeding and breed on average milk yield (L)
Tablica 7: Utjecaj dodate krmne smjese, mjeseca hranidbe i pasmine na prosječnu mliječnost krava (L)

Feed / Krma	Month / Mjesec	Breed / Pasmina	$\overline{x}$ ±SD	n
C-A / KS-A	1	HF / HF	17.86±7.46	15
		SI / SI	15.95±5.84	14
		CB / KR	22.63±7.21	6
		$\overline{x}$	17.91±7.01	35
	2	HF / HF	21.26±9.09	16
		SI / SI	18.08±5.62	15
		CB / KR	24.17±6.62	7
		$\overline{x}$	20.54±7.60	38
	3	HF /HF	21.20±9.18	18
		SI / SI	16.97±6.38	15
		CB / KR	16.74±5.27	7
		$\overline{x}$	18.83±7.77	40
	In total / Ukupno	**HF / HF**	**20.20±8.62**	**49**
		SI / SI	**17.02±5.88**	**44**
		CB / KR	**21.11±6.89**	**20**
		$\overline{x}$	**19.12±7.49**	**113**
C-B / KS-B	1	HF / HF	24.62±10.76	14
		SI / SI	20.39±5.39	16
		CB / KR	21.82±2.43	4
		$\overline{x}$	22.30±7.97	34
	2	HF / HF	26.96±7.77	13
		SI / SI	19.16±6.75	16
		CB / KR	20.86±3.73	6
		$\overline{x}$	22.34±7.53	35
	3	HF / HF	26.16±7.84	15
		SI / SI	17.17±6.29	14
		CB / KR	19.37±5.78	7
		$\overline{x}$	21.35±7.92	36
	In total / Ukupno	**HF / HF**	**25.90±8.74**	**42**
		SI / SI	**18.98±6.17**	**46**
		CB / KR	**20.47±4.36**	**17**
		$\overline{x}$	**21.99±7.75**	**105**

It is recommendable that a preparation accelerating the action of cellulitic microorganisms, improving the decomposition of crude fiber and increasing the milk quantity for about 2 L daily, should be added to the recommended ration.

When feeding milking cows in the second test period, the recommended ration of the concentrate B maker was considerably approached. In that period the basic ration consisted of 1.5 kg of hay, 15 kg of grass silage and 22 kg of maize silage.

It was complemented by maize meal, sunflower meal, soy bean meal and concentrated B. 1 kg of concentrate B was added in case of 24 L/day milk production, 2 kg in case of 28 L/day milk production, 6 kg in case of 34 L/day milk production and 8 kg in case of 40 L/day milk production.

Results of milk production and milk quality parameters

By the analysis of variance for the studied influences on the milk quantity and composition a statistically significant ($P<0.05$) influence of the feed and breed on the milk quantity, influence of the breed on the protein percentage, influence of the number of days in lactation on the milk quantity and the milk fat and protein percentages were established.

Table 6 shows that 113 cows were included in the three month testing during the first test period lasting from December 1, 2004 to February 28, 2005 when concentrate A was added to the basic ration which was identical throughout testing.

During this period the cows yielded on the average 19.13 L of milk per cow daily. During the second period, lasting from April 1, 2005 to June 30, 2005, 105 cows were included in the test during three months. Their average milk yield was statistically significantly ($P<0.05$) higher than the milk quantity during the first period and amounted to 21.99 L per cow daily. Dihman et al. (2001) associate the influence on the milk quantity with the proteins surrounded by fat. Cows with different additions in the ration were tested; the first group had the addition of fats, the second group had the addition of fat and proteins not decomposable in the intestines and the third group had the proteins surrounded by fat. In the first group statistically significant deviation of the milk quantity from the remaining herd was established, whereas in the second and third groups it was established that there were no differences in the milk quantity, but in the protein content in the milk.

Table 7 shows that the average daily milk quantity of milking cows in the second test period was 2.87 L higher than in the first test period. Also a difference between the individual breeds within the test period as well as between the two test periods can be observed. It can be seen that the average daily quantity of milk of HF cows during the second test period was 5.7 L higher than during the first test period. Likewise, during the second test period the average daily milk production of the Simmental breed was 1.96 L higher than during the first test period.

In distinction from HF and Simmental breeds the crossbred milking cows during the second test period had 0.64 L lower average milk production than during the first test period. In the table it can also be seen that there are differences in the average milk production between breeds within the individual test period as well as between breeds within the individual month.

However, irrespective of considerable differences in the average daily milk yield the analysis of variance for the interaction between feed*month*breed shows that the interaction of the mentioned influences is not statistically significant ($P = 0.749$). However, the breed itself ($P<0.05$) has a statistically significant influence on the milk quantity.

Table 8 shows the number of animals included in the test during the individual period and the average values of protein and fat contents in milk.

The table shows that there are no statistically significant ($P<0.05$) differences in the protein content in milk between the two test periods. Nevertheless, a slight increase of the protein content in milk during the second period in comparison with the first period can be observed. This slight increase warns that the protein content will have to be followed up also in the future, since it may still increase. Anyhow, the protein content in the herd studied

Table 8: Number of cows in the test during the individual period and protein and fat contents in milk
Tablica 8: Broj krava u pokusu u pojedinom razdoblju i udjel proteina i masti u mlijeku

Feed Krma	n	$\bar{x}$ proteins (%) ± SD $\bar{x}$ proteini (%) ± SD	$\bar{x}$ fats (%) ± SD $\bar{x}$ mast (%) ± SD
C-A KS-A	113	3.54±0.45	4.14±0.74
C-B KS-B	105	3.55±0.42	4.13±0.76

Table 9: Average protein and fat percentage in milk when feeding two different concentrates
Tablica 9: Prosječni postotak proteina i masti u mlijeku kod ishrane dvama različitim krmnim smjesama

Feed Krma	Breed Pasmina	n	$\bar{x}$ proteins (%) ± SD $\bar{x}$ proteini (%) ± SD	$\bar{x}$ fats (%) ± SD $\bar{x}$ mast (%) ± SD
C-A KS-A	Holstein Friesian Holštajnsko-frizijska	49	3.55±0.48	4.25±0.76
	Simmental Simentalac	44	3.63±0.44	4.14±0.83
	Crossbreed Križanci	20	3.34±0.34	3.86±0.45
	$\bar{x}$	113	3.55±0.45	4.14±0.74
C-B KS-B	Holstein Friesian Holštajnsko-frizijska	42	3.47±0.53	4.02±0.83
	Simmental Simentalac	46	3.66±0.34	4.31±0.79
	Crossbreed Križanci	17	3.46±0.23	3.93±0.36
	$\bar{x}$	105	3.56±0.42	4.13±0.76
In total Ukupno	Holstein Friesian Holštajnsko-frizijska	91	3.52±0.50	4.15±0.78
	Simmental Simentalac	90	3.65±0.39	4.22±0.81
	Crossbreed Križanci	37	3.40±0.30	3.89±0.40
	$\bar{x}$	218	3.55±0.44	4.14±0.75

is satisfactory and/or good, if compared with the Slovene average. Sadar (2007) states that the average percentage of the proteins on all controlled cows in Slovenia in 2006 was 3.26. Out of this the average protein percentage of the brown breed was 3.33 %, of the Simmental breed it was 3.29 % and of the HF breed 3.20 %. Contrary to proteins a slight drop can be noticed in case of fats during the second period in comparison with the first period. Irrespective of the low decrease of fats this is still higher than the average of fats of the controlled cows in Slovenia in 2006, namely 4.09 %. In Slovenia in 2006 cows reached the following fat contents in milk: brown breed reached 4.11 %, Simmental breed 4.17 % and the Holstein Friesian breed 4.02 % (Sadar, 2007).

Table 9 shows the protein and fat percentage breed by breed when feeding two different concentrates.

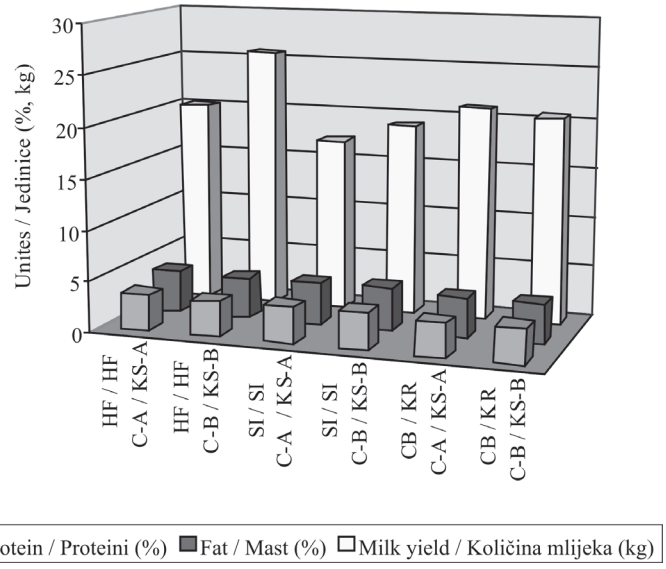
The table shows that the protein percentage in the HF breed, when feeding the concentrate B, dropped for 0.08 %, which can be associated with the strong increase of the milk quantity of that breed. In the Simmental breed the protein percentage increased for 0.03 %, when feeding the concentrate B, while in the crossbreeds it has also increased for 0.08 %. When feeding the concentrate B, the fat percentage of the HF breed dropped for 0.23 %, which can be associated again with the strong increase of the milk quantity in this breed. When feeding the concentrate B the fat percentage of the Simmental breed increased for 0.17 %, while in case of crossbreeds it has increased for 0.07 %, but the crossbreeds had the lowest fat percentage in milk.

Figure 1 shows the average values of the milk quantity and the protein and fat contents in the milk for the individual breed depending on the concentrate type.

In the figure it can be seen that the cows of HF breed reached the highest milk production of 25.9 L/day in the second test period, when the concentrate B was fed. They are followed in the milk quantity by the crossbred cows during the first period with 21.1 L of milk daily, when feeding the concentrate A. Throughout, cows of the Simmental breed had the lowest milk production, i.e., 17.2 L of milk daily during the first test period and 19 L/day during the second test period when feeding the concentrate B.

Cows of the Simmental breed reached the highest protein content, namely 3.66 % when feeding the concentrate A and 3.63 % when feeding the concentrate B. Crossbred cows had the lowest protein content in the milk in case of feeding during both test periods. When concentrate A was fed, they reached 3.34 % of proteins, whereas when feeding

Figure 1: Average milk quantity, protein and fat contents depending on breed and concentrate
Grafikon 1: Prosječna količina mlijeka, postotak proteina i masti u ovisnosti o pasmini i krmnoj smjesi



the concentrate B, the protein content increased to 3.46 %. Like in case of proteins it can be observed that the cows of the Simmental breed had the highest fat content (4.31 %) in milk, however only when feeding the concentrate B. When feeding the concentrate A, the cows of the HF breed reached the highest fat content (4.25 %) in milk. Similarly to the protein content in milk the lowest fat content in milk was observed on the crossbred cows when feeding both concentrates.

When feeding the concentrate A, the average protein content in milk was 3.54 % and the average fat content was 4.14 %. The ratio between fats and proteins was 1:1.17. During the second period, when the concentrate B was fed, the average protein content in milk was 3.55 % and the average fat content was 4.13 %. The ratio between fats and proteins was 1:1.16. Babnik et al. (2004) state that the ratio between fats and proteins should vary between 1.1 and 1.5. In this test the ratio was very similar and within the recommended interval when feeding both concentrates.

Conclusions

In the research the influence of supplementary concentrate on the milk quantity and protein and fat contents were studied. The comparable concentrates A and B mutually differed in the contents of raw proteins, raw fats, nitrogen-free extract, digestible crude proteins and energy, respectively. While the concentrate B contained higher amounts of crude fiber, crude fat, non nitrogen extract, NEL and digestible proteins were lower than comparable concentrate.

On the basis of analysis of the variance a statistically significantly ($P<0.05$) higher milk production of the milking cows was established when feeding the concentrate B. When feeding the concentrate A the average milk production was 19.12 liters/day, whereas when feeding the concentrate B it was 21.99 liters/day.

When feeding the concentrates A and B no statistically significant differences ($P<0.05$) in protein content in milk were found. However, when feeding concentrate B the protein content was a little higher and amounted to 3.55 %, while when feeding with concentrate A the protein content was 3.54 %.

When feeding concentrates A and B no statistically significant differences ($P<0.05$) of fat content in milk were found. When feeding concentrate A the fat content was slightly higher and amounted to 4.14 %, whereas when feeding the concentrate B the fat content was 4.13 %.

Utjecaj zamjene koncentrata na farmi krava muzara

Sažetak

Željeli smo utvrditi utjecaj koncentrata A i B na količinu i sastav namuzenog mlijeka krava muzara. U istraživanje smo uključili krave holštajnsko-frizijske i simentalske pasmine te križance sa simentalskom pasminom. Pokus smo proveli u dva razdoblja. Prvo razdoblje s koncentratom A trajalo je od prosinca 2004. do veljače 2005. sa 113 uključenih krava. U drugom razdoblju s koncentratom B pokus je realiziran od travnja do lipnja 2005. Dobivene rezultate za količinu

mlijeka, sadržaj proteina i masti kod svake mjesečne kontrole stavili smo u Excel te ih statistički obradili pomoću SPSS for Windows 12.0. Količina mlijeka iznosila je uz hranidbu koncentrata B 21,99 L/dan i bila je statistički signifikantno (P<0,05) veća od količine mlijeka kod primjene koncentrata A, gdje je iznosila 19,12 L/dan. Kod sadržaja proteina i masti u mlijeku nismo utvrdili statistički signifikantnih razlika (P<0,05).

Ključne riječi: krave muzare, koncentrat, količina mlijeka, proteini, mast

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