Biotechnology in Animal Husbandry 27 (3), p 1001-1007 , 2011
Publisher: Institute for Animal Husbandry, Belgrade-Zemun
ISSN 1450-9156
UDC 636.087.7
DOI: 10.2298/BAH1103001I

ZEOLITE AS A FACTOR IN THE IMPROVEMENT OF SOME PRODUCTION TRAITS OF DAIRY CATTLE

Z. Ilić[1], M. P. Petrović[2], S. Pešev[3], J. Stojković[1], B. Ristanović[1]

[1]Faculty of Agriculture, Lešak, Republic of Serbia
[2]Institute for Animal Husbandry, Belgrade, Republic of Serbia
[3]FSH Agromil, Pojate, Republic of Serbia
Corresponding author: ilzoama@open.telekom.rs
Original scientific paper

Abstract: Milk yield and milk chemical composition are largely affected by diet quality. Natural zeolite has been successfully used in livestock production as a feed supplement for some types and categories of domestic animals. This experiment was conducted over a period of 15 months involving Domestic Spotted dairy cattle. The test animals were assigned to three groups, each receiving different levels of supplemental zeolite. The control group comprised cows that received no zeolite supplement. Experimental groups I and II were fed compound feeds supplemented with 4% and 2% zeolite, respectively. The production traits studied included the following milk performance traits: whole lactation length, milk and fat yields over whole lactations, milk and fat yields over standard lactations. The results obtained suggest that zeolite supplementation affects some production traits, depending on the zeolite level present in livestock feed.

Key words: dairy cows, zeolite, milk performance, milk fat

Introduction

Milk yield and milk quality of dairy cows are largely affected by diet quality. Natural zeolite has been successfully used in livestock production as a feed supplement for some types and categories of domestic animals. Related studies in dairy cattle were conducted by *Harvey et al. (1991), Neustroyev et al. (1995), Nešić (2000), Pešev et al. (2005)* and *Ilić et al. (2007)*.

Production performance parameters are affected by livestock feeds that contain mycotoxins. *Harvey et al. (1991), Neustroyev et al. (1995), Ilić et al. (2005), Pešev et al. (2005)*, *Mohri et al. (2008)* justify the use of zeolite in livestock feeds fed to lactating cows.

Materials and Methods

This study involved 45 Domestic Spotted dairy cattle. The test animals were assigned to 3 groups each comprising 15 animals and involving use of different levels of supplemental zeolite. The control group (C) received no zeolite supplement. Experimental group I (E-I) and Experimental group II (E-II) were fed rations i.e. compound feeds supplemented with 4% and 2% zeolite, respectively.

The trial was conducted at a dairy farm in Veliki Šiljegovac.

The production traits studied included the following milk performance traits: whole lactation length, milk and fat yields over whole lactations, and milk and fat yields over standard lactations.

The objective of this study was to perform complex evaluation of the effect of different levels of supplemental zeolite (commerce name „Tufozel“ origin from Serbia) on production performance. „Tufozel” is a finely micronized thermally and technologically treated feed supplement that exhibits a highly selective adsorption capacity for mycotoxins, unharmful, insoluble, non-resorptive and leaves no residue in milk.

Results and Discussion

Milk and fat yields are breed traits affected by external factors. The effect of genetic factors is estimated at about 25% and that of environmental factors at about 75%. Among environmental factors, nutrition has the highest impact.

Milk yield over the whole lactation is defined as milk yield over the total length of lactation.

Table 1. presents the lengths and variability of whole lactations.

The average lactation length in control cows was 312 days, ranging from 300 to 360 days. The values obtained by the control group were between those of the other two groups.

Table 1. Duration and variability of whole lactations, days

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Variations		Fexp
						min	max	
E-I	15	306	4.32	16.82	5.50	300	360	
E- II	15	327	15.62	60.47	18.46	270	465	6.26*
C	15	312	5.71	22.10	7.08	300	360	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

Statistical differences in whole lactation length between the groups were found to be significant (P<0.05).

The results obtained in this study are in agreement with those reported by *Ivanov (1990)* and *Ilić et al. (2005).* The control group findings conform with the results of *Petrović (2000)* and *Važdić (2005).*

The average milk yield over whole lactations is given in Table 2.

Table 2. Average milk quantities in whole lactations, kg

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV%	Variations		Fexp
						min	max	
E-I	15	6714.13	251.26	972.40	14.48	4274.00	8730.00	
E- II	15	6934.13	256.67	993.31	14.32	5490.00	9120.00	17.46**
C	15	6395.20	149.90	580.14	9.07	5349.00	7200.00	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

Milk yield over whole lactations was highest in E-II cows receiving 2% zeolite supplementation, followed by E-I and C cows. Milk yield over whole lactations showed very significant statistical differences between the groups (P<0.01).

Table 3. outlines milk yield over standard lactations.

Table 3. Average milk production in standard lactations, kg

Grop Grua	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Variations		Fexp
						min	max	
E-I	15	6690.86	224.00	866.89	12.95	4314.50	7780.00	
E- II	15	6711.80	152.52	590.28	8.79	5190.00	7650.00	15.29**
C	15	6342.33	164.77	637.68	10.05	5384.00	7280.00	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

The lowest average milk yield was observed in C-group cows. A somewhat higher yield was produced by cows receiving zeolite. E-I group cows received 4% zeolite supplementation through compound feeds and gave an average milk yield of 6690.86 kg. The average milk yield of 6711.80 kg was obtained by E-II group cows that were fed rations supplemented with 2% zeolite.

The highest average milk yield over standard lactations and the lowest variation coefficient were obtained by E-II group cows. Milk yield over standard lactations showed very significant statistical differences between the groups (P<0.01).

Milk performance in the present study was higher than in similar research on this trait in the same breed of cattle. Lower milk performance was reported by a number of authors: *Feddersen et al. (1995)* in German Simmental cattle, *Gottschalk (1996)* and *Gutić (1998)* in Montbéliarde cattle, *Ivanov (1990)* in

Bulgarian Simmental cows, *Vetuška (1996)* and *Urban (1998)* in Czech Simmental cattle.

Milk fat production during lactation is a breed trait dependent upon nutrition, among other factors. The average milk fat yield over whole lactations is presented in Table 4.

Table 4. Average milk fat quantity in whole lactations, kg

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV%	Variations, kg		Fexp
						min	max	
E-I	15	284.44	12.54	48.58	17.10	178.39	378.30	
E- II	15	291.66	11.76	45.53	15.61	230.58	401.28	12.96**
C	15	262.93	6.78	26.24	9.98	216.10	298.80	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

The average milk fat yield was lowest in control cows and highest in E-II group cows. The milk fat yield values determined for E-I group cows were between those obtained by the two other groups, but the highest variation in this trait was observed in E-I group cows. Control cows had the lowest milk fat yield, but also the lowest coefficient of variation.

Very significant statistical differences were observed in milk fat content over whole lactations between the test groups (P<0.01).

Table. 5 presents the values of milk fat yield over standard lactations.

Table 5. Variability and milk fat production in standard lactations, kg

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Variations		Fexp
						min	max	
E-I	15	283.40	11.50	44.50	15.70	179.91	337.13	
E- II	15	278.45	5.65	21.89	7.86	247.04	319.01	12.01**
C	15	260.93	6.78	26.24	9.98	217.51	302.12	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

Table 5. shows that the average milk fat yield over standard lactations in E-I group cows was 283.40 kg, ranging from 179.91 kg to 337.13 kg. This group of cows had the lowest milk fat yield (179.91 kg) among the groups, and the highest milk fat yield (337.13 kg), with the coefficient of variation being, therefore, highest in this same group, among all groups (15.70%).

Statistical differences in milk fat yield over standard lactations between groups were very significant (P<0.01).

A lower milk fat yield was obtained by *Miščević (1995), Miščević et al. (1995), Perišić (1998)* and *Petrović (2000),* as opposed to higher values reported by *Gutić (1998), Gutić et al. (1998)* and *Urban et al. (1998).*

Conclusion

The average lactation length in control cows was 312 days, ranging from 300 to 360 days. The values obtained by the control group were between those of the other two groups. Statistical differences in whole lactation length between the groups were found to be significant ($P<0.05$).

Milk yield over whole lactations was lowest in C group cows (6395.20 kg), followed by E-I group cows (6714.13 kg) and E-II group cows (6934.13 kg) receiving 2% zeolite as a feed supplement. Very significant statistical differences were observed in milk yield over whole lactations between groups ($P<0.01$).

The lowest average milk yield was observed in C-group cows (6342.33 kg). A somewhat higher yield was produced by zeolite-fed cows. E-I group cows received 4% zeolite supplementation and gave an average milk yield of 6690.86 kg. The highest average milk yield of 6711.80 kg was obtained by E-II group cows that were fed feeds supplemented with 2% zeolite.

The highest average milk yield over standard lactations and the lowest variation coefficient were obtained by E-II group cows. Milk yield over standard lactations showed very significant statistical differences between the groups ($P<0.01$).

The average milk fat yield was lowest in control group cows and highest in E-II gropup cows. Very significant statistical differences were observed in milk fat yield over whole lactations as well as over standard lactations between the test groups ($P<0.01$).

Acknowledgment

Research was financed by the Ministry of Education and Science, Republic of Serbia, project TR 31001.

Zeolit kao faktor poboljšanja nekih proizvodnih osobina kod krava muzara

Z. Ilić, M. P. Petrović, S. Pešev, J. Stojković, B. Ristanović

Rezime

Kontrolna grupa krava imala je prosečno trajanje laktacije od 312 dana, sa varijacijama od 300 do 360 dana. Ova grupa se po dobijenim rezultatima nalazi

između ostale dve grupe krava. Statističke razlike u trajanju celih laktacija među grupama su značajne (P<0,05).

Najniža proizvodnja mleka u celim laktacijama zabeležena je kod krava K-grupe (6395,20 kg), viša kod krava I-O grupe (6714,13 kg) i najviša kod krava II-O grupe (6934,13 kg) koja je dobijala 2% zeolita preko krmnih smeša. Statističke razlike u proizvodnji mleka u celim laktacijama među grupama su vrlo značajne (P<0,01).

Najmanja prosečna produkcija mleka zabeležena je kod krava K-grupe (6342,33 kg). Znatno veća proizvodnja je bila kod krava koje su dobijale zeolit. Krave I-O grupe dobijale su 4% zeolita i postigle su prosečnu mlečnost od 6690.86 kg. Krave II-O grupe dobijale su 2% zeolita i postigle su najveću prosečnu mlečnost od 6711.80 kg. Krave II-O grupe imale su najveću prosečnu proizvodnju mleka u standardnim laktacijama i najniži koeficijent varijacije među grupama. Statističke razlike u proizvodnji mleka u standardnim laktacijama među grupama su vrlo značajne (P<0,01).

Krave K-grupe imale su najmanju prosečnu priozvodnju mlečne masti u mleku, a krave II-O grupe najveću. Statističke razlike u količini mlečne masti u celim laktacijama među grupama su vrlo značajne (P<0,01). Takođe su vrlo značajne (P<0,01) i statističke razlike među grupama u količini mlečne masti u standardnim laktacijama.

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Received 30 June 2011; accepted for publication 15 August 2011