

EFFICIENCY OF ZEOLITE BASIS PREPARATION IN FATTENING LAMBS DIET

J. Stojković¹, Z. Ilić¹, S. Ćirić¹, B. Ristanović¹, M. P. Petrović², V. Caro Petrović², V. Kurčubić³

¹ University of Pristina, Faculty of Agriculture, Kopaonicka bb, 38219 Lesak, Serbia

²Institute for Animal Husbandry, P. O. Box 23, 11081 Zemun, Belgrade, Serbia.

³Faculty of Agronomy, Cara Dusana 34, 32000 Cacak, Serbia, University of Kragujevac

Corresponding author: jovanips@gmail.com

Original scientific paper

Abstract: The paper presents the results of a research on the impact of products based on natural zeolite on the production results of fattening lambs. The experiment involved two groups of lambs (the control - C and experimental – E groups), each consisting of 15 heads, for a period of 90 days. The meal was made from sheep milk, feed mixtures for fattening lambs and meadow hay. The test group lambs, unlike the ones from the control group, were given mixtures based on natural zeolite. Min-a-Zel S mixture (in the form of 25% composite) was fed to lambs from birth till their 14th day of life, directly into the mouth, once a day (before the morning feed), in the amount of 10 ml. Min-a-Zel Plus was given to them from their 15th day of life, together with the feed mixture (0.5%). Feeding was at will. The average weight of lambs at the end of the experiment, in accordance with the sequence of treatments (C:E) was 24.40:26.94 kg (P <0.01). Daily weight gain of lambs, during the experiment, was 229:256 g and in the experimental group it was by 27g or 11.79% higher (P <0.01). The test group lambs had a better utilization of dry matter, protein and energy, which justifies the use of products based on natural zeolite in fattening lambs.

Key words: lambs, zeolite, body weight, weight gain, feed conversion

Introduction

Modern-day livestock production requires constantly finding new opportunities to improve the production results and preserve the health of domestic animals. In the last decade several researches have been done on the possibilities of implementing natural zeolite in livestock production (*Masic et al. 1999, Nikkhah et al. 2001, Ilic et al. 2005, Pesev et al. 2005, Ilic et al. 2007, Shariatmandari F. 2008*) Because of its great ability to absorb various harmful substances in the body of animals and the environment (mycotoxins, radionuclides, heavy metals,

ammonia, carbon monoxide, pesticides and herbicides), it helps to achieve better production results and maintain the health and reproductive performance of domestic animals (*Adamovic et al. 2001, Dakovic et al. 2003, Medakovic and Zaric 2005*). *Stojković (2006)*, have established that the newborn lambs, that were fed the product based on natural zeolite through colostrum (Min-a-Zel S in the amount of 5 g/l of colostrum), had more than 50 percent higher concentration of immunoglobulin (IgG) after the period of six hours. Later, 24 and 48 hours after the birth, the values of IgG also increased, indicating the contribution of these drugs in strengthening the immune system of lambs in their first days of life.

The aim of this study was to determine the influence of products based on natural zeolite (Min-a-Zel S and Min-a-Zel Plus) on major production performance of fattening lambs. Min-a-Zel S is a 25% composite of a processed zeolite concentrate, containing 90% of clinoptilolite. Min-a-Zel Plus represents a new generation of mineral mycotoxin adsorbent, obtained by an organic modification of a zeolite mineral clinoptilolite with a long-chain quaternary amine.

Material and methods

The experiment involved two groups (the control - C and the experimental-E groups), each consisting of 15 lambs, and it was organized on a Mramor farm, near Niš. The experiment was realized in January-March 2011, in a period of 90 days. Lambs were fed a meal consisting of sheep's milk, feed mixtures for fattening lambs and meadow hay. Lambs were reviewed when they were 60 days old. The experimental group lambs, unlike the control group ones, received the products based on natural zeolite. Min-a-Zel S mixture was fed to the lambs from birth to their 14th day of life, directly in the mouth once a day (before the morning feed) in the amount of 10 ml. They were given Min-a-Zel Plus from their 15th day of life, together with the feed mixture (0.5%). Lamb feeding was at will. Standard chemical analysis was conducted on the feed samples used (milk, feed mixtures and hay) at the beginning of experiment (Table 1).

Table 1. Chemical composition of used feedstuffs (calculated to % of DM)

Parameter	Concentrate mixture	Meadow hay	Sheep milk
Dry matter	88.55	89.50	18.10
Proteins	15.10	11.20	6.05
Ash	5.64	7.15	0.66
Fat	2.70	2.05	7.30
Cellulose	9.90	27.36	0.00
NFE	54.90	41.70	4.20
ME, MJ/kg	7.10	0.56	2.50
Ca (g)	0.74	0.70	0.20
P (g)	0.55	0.51	0.14

Body weight of lambs was measured at birth and then at 30, 60 and 90 days of the age. Food consumption was monitored daily. Statistical analysis was done by the Statistica program, Version 6, StatSoft. Inc. (2003).

Results and Discussion

The results of the achieved lamb weight (Table 2) indicate that the lambs which received Min-a-Zel S and Min-a-Zel Plus were more advanced. At 60 days old, lamb body weight, in accordance with the sequence of treatments C:E was 17.79:18.91 kg, and the noticeable differences were statistically significant ($P < 0.05$). At the end of the experiment (90 days old) lamb body weight was 24.48:26.94 kg, and the noticeable differences were statistically highly significant ($P < 0.01$).

Table 2. Body weight of lambs , kg

Age, day	Control group		Experimental group		Index Control=100
	x	Sd	x	Sd	
0	3.85	0.41	3.91	0.34	101.56
30	11.93	1.55	12.20	1.42	102.26
60	17.79	1.31	18.91*	1.43	106.29
90	24.48	2.52	26.94**	1.79	110.05

* $P < 0.05$; ** $P < 0.01$

The average daily gain of lambs (Table 3) in their first month (C:E) was 269:276 grams. In the experimental group it was 7 g or 2.60% higher ($P > 0.05$). In their second month, average daily gain was 195:224 grams, with the established differences in favor of the experimental group, where the gain was higher than in the first month (29 g, or 14.87%), but it was not statistically significant ($P > 0.05$). Daily gain of lambs between their 61st and 90th day was 223:268 grams. The established differences of 45 g, or 20.18% were in favor of the experimental group and were statistically significant ($P < 0.05$).

Table 3. Daily gain of lambs, g

Age, day	Control group		Experimental group		Index Control=100
	x	Sd	x	Sd	
0-30	269	3.50	276	4.06	102.60
31-60	195	2.69	224	4.74	114.87
61-90	223	5.50	268*	3.11	120.18
0-90	229	2.68	256**	2.26	11.79

* $P < 0.05$; ** $P < 0.01$

Throughout the experiment (0-90 days), the achieved gain was 229:256 grams, and the established differences of 27 g or 11.79% were in favor of the experimental group and were statistically highly significant ($P < 0.01$). Larger differences in growth rates, in favor of the experimental group, were created in the second and the third month after their birth, when the lambs acquired most of the nutrients from the concentrate feed that included Min-a-Zel Plus.

This was achieved through the features of this product of the new generation which allow it to bind a number of harmful substances (mycotoxins, radionuclides, heavy metals, ammonia, etc.) that enter the body through food, thereby preventing their negative impact. Some other authors have also determined the positive effects of zeolite, but with some minor differences in weight gain. *Stojkovic et al. (2005)* have added clinoptilolite to feed mixtures for lambs, thus achieving a daily gain of 167 to 196 grams. By using the same product (Min-a-Zel Plus) in fattening lambs, in the amount of 0.2 percent and 0.5 percent of the feed mixtures, (*Jašović et al. 2009*,) have achieved the daily weight gain of 209 g and 179g, where increasing the dosage of the product did not further affect the body weight gain. However, increasing the dosage of Min-a-Zel Plus, in this study, resulted in the elimination of zearalenone residues in the liver, kidneys and muscles, which is the real significance of these test results. By adding 0.2%, or 0.5 percent of zeolite-based product, of the older generation, to the feed mixture for lambs, (*Nikkhaha et al. 2001*) found a slight increase in body weight of lambs (2%) and daily gain (3%), which is significantly less than the determined growth increase of this particular study. *Adamović et al. (2002)* have also determined that lambs, that were fed a diet supplemented with clinoptilolite, did achieve better results. *Stojković et al. (1999)* did not get positive results by adding zeolite to the feed mixtures for lambs, which is probably the consequence of differences in the type of zeolite used.

Somewhat larger differences in weight gain in this experiment probably resulted from the combined effect of two zeolite-based products operating at different stages of lamb's life. The effects of Min-a-Zel S mixture (used for the first 14 days) contributed to the achievement of better results in the first weeks of lambs' lives, when the consumption of the mixture was insignificant. The positive influence of the Min-a-Zel Plus product was achieved between the 30th and the 90th day, at a time when the lambs were accustomed to a greater intake of mixture which was supplemented by this product.

It was noticed that there was a slightly larger consumption of dry matter, protein and energy (Table 4) in the first 60 days in lambs of the experimental group, that were fed products based on zeolites. In the period from the 60th to the 90th day, there was a difference found in the control group that amounted to a higher consumption of dry matter, protein and energy, which was not accompanied by an adequate increase of weight gain in lambs, that is, it did not contribute to the manifestation of the effects of compensatory growth. The efficiency of the

utilization of dry matter, protein and energy during the experiment (0-90 day) was, except for the first month, noticeably better in lambs in the experimental group (Table 5).

Table 4. Nutrient intake

Nutrient	Experimental period, days	Control group	Experimental group	Index Control=100
Dry matter, kg	0-30	0.11	0.12	109.09
	31-60	0.49	0.51	104.06
	61-90	0.80	0.56	93.75
	0-90	0.49	0.48	97.96
Protein, g	0-30	39	40	100.56
	31-60	90	94	104.40
	61-90	137	128	93.43
	0-90	91	91	100.00
ME, MJ/kg	0-30	1,60	1.62	101.25
	31-60	3,99	4.12	103.26
	61-90	6,15	5.79	94.15
	0-90	4,09	4.09	100.00

The consumption of dry matter per kilogram of gain in the experimental group compared to the control group was reduced by 12.21 percent, and the consumption of protein and energy by 10.58 percent, which confirms that the mixtures used (Min-a-Zel S and Min-a-Zel Plus) had a positive influence on food utilization efficiency. In the control group, of lambs 15 to 20 days old, five of the lambs developed a diarrhea, which occurred again at 60 to 68 days of life. In the experimental group of lambs there was no noticeable form of diarrhea, which is likely due to the mixtures being previously tested.

Table 5. Nutrient utilization

Nutrient	Experimental period, days	Control group	Experimental group	Index Control=100
Dry matter, kg	0-30	0.41	0.43	104.88
	31-60	2.51	2.28	90.84
	61-90	3.58	2.80	78.21
	0-90	2.13	1.87	87.79
Protein, g	0-30	145	145	100.00
	31-60	461	420	91.11
	61-90	614	478	77.85
	0-90	397	369	89.42
ME, MJ/kg	0-30	5.95	5.87	98.65
	31-60	20.46	18.39	89.88
	61-90	27.58	21.60	78.32
	0-90	17.87	15.98	89.42

Conclusion

Utilization of zeolite-based products (Min-a-Zel S and Min-a-Zel Plus) had a positive effect on growth, utilization and utilization efficiency of dry matter, protein and energy. Average daily gain was higher in the experimental group, by 27 g or 11.79 percent. The consumption of dry matter per kilogram of gain, in the same group, was reduced by 12.21 percent, and of protein and energy by 10.58 percent. Lower incidence of diarrhea was observed in the experimental group.

Acknowledgements

This study is part of the projects TR 31001 "An environmental approach and implementation of modern biotechnologies as a basis for the improvement of ruminant breeding technology", and TR 31053 "Modern biotechnology solutions in the breeding and feeding of cattle sheep and goats for the production of valuable and safety food" financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Efikasnost primene preparata na bazi zeolita u obrocima jagnjadi u tovu

J. Stojković, Z. Ilić, Slavica Ćirić, B. Ristanović, M. P. Petrović, Violeta Caro Petrović, V. Kurćubić

Rezime

U radu su prikazani rezultati istraživanja o uticaju preparata na bazi prirodnog zeolita na proizvodne rezultate jagnjadi u tovu. Ogled je izveden na dve grupe jagnjadi (kontrolna – K i ogledna – O), po 20 jagnjadi u trajanju od 90 dana. Obrok se sastojao od ovcjeg mleka, krmne smeše za tov jagnjadi i livadskog sena. Iskorišćavanje preparata na bazi zeolita (Min-a-Zel S i Min-a-Zel Plus) pozitivno je uticalo na prirast, iskorišćavanje i efikasnost iskorišćavanja suve materije, proteina i energije. Prosečan dnevni prirast bio je veći kod jagnjadi ogledne grupe za 27 g ili 11,79 posto. Utrošak suve materije za kilogram prirasta u istoj gupi, bio je manji za 12,21 posto a proteina i energije za 10,58 posto. Manja učestalost javljanja proliva bila je kod jagnjadi ogledne gupe.

References

- ADAMOVIĆ M., NEŠIĆ S., STOIČEVIĆ S., TOMAŠEVIĆ-ČANOVIĆ MAGDALENA (2001): The influence of Min-a-Zel Plus modified organic adsorbent on the quality of crop silage IX Yugoslav Symposium of forage crops. Belgrade.
- ADAMOVIĆ M., TOMAŠEVIĆ-ČANOVIĆ MAGDALENA, MILOŠEVIĆ. (2002): The contribution of mycotoxin mineral adsorbents to the increase of production and food quality. Eco-Conference. Novi Sad.
- DAKOVIĆ A., TOMAŠEVIĆ ČANOVIĆ M., RATTINGHAUS G., DONDUR V., ĐORĐEVIĆ N., ADAMOVIĆ M., GRUBIĆ G., KOLJAJIĆ V. BOČAROV-STANČIĆ A. (2003): The influence of Min-a-Zel Plus on biochemical, microbiological, mucotoxicological parameters of alfalfa silage. Journal of Agricultural Sciences, vol. 48, br. 2, str. 171-178.
- ILIĆ Z., PEŠEV S., SIMEONOVA VALENTINA, MILOŠEVIĆ B., SPASIĆ Z. (2005): The influence of zeolite type tufozel on productive characteristics of dairy cows. Biotechnology in animal husbandry, VOL 21 (5-6), p 25-30, UDC 636, ISSN 1450-9156, Belgrade- Zemun.
- ILIĆ Z., PEŠEV S., MILENKOVIĆ M., MILOŠEVIĆ B. (2007): IMPACT ON THE ZEOLITE USAGE IN DIARY COWS NUTRITION TO THEIR HEALTH CHARACTERISTICS. ISSN 1450-9156. Biotechnology in animal husbandry, VOL 23 (5-6), p, 25-33, Belgrade-Zemun.
- JAŠOVIĆ B., STOJKOVIĆ J., MILENKOVIĆ M., MILOŠEVIĆ B., ILIĆ Z. (2009): Uticaj mineralne smeše sa pufernim dejstvom na proizvodne rezultate jagnjadi u tovu. Agro-knowalage Jurnal, vol. 10, br. 4, 125-128.
- MEDAKOVIĆ V., ZARIĆ V. (2005): Adsorption of mycotoxins by organozeolites. Colloids and Surfaces B Biointerfaces, 46 (1): 20-25.
- MAŠIĆ Z., KLJAJIĆ R., BOČAROV-STANČIĆ S., ŠKRINJAR M. (1999): Mikotoksini u stočnoj hrani kao factor poremećaja zdravlja životinja. 12 Savetovanje veeinarara Srbije, Vrnjačka banja, 65-73.
- NIKKHAH A., BABAPOOR M., MORADI-SHAHRBABA (2001): Effect of clinoptilolite – rich tuff on the performance of Varmini male lambs. Teheran, Iran.
- PEŠEV S., ILIĆ Z., SIMONOVA V., MILOŠEVIĆ B., SPASIĆ Z. (2005): The influence of the zeolite type tufozel on dairy cows reproductive characteristics. Biotechnology in Animal Husbandry, vol. 21, br. 5-6, str. 19-24
- STATISTICA, verzion 6, StotSoft. Inc (2003). www.statsoft.com.
- STOJKOVIĆ J., ADAMOVIĆ M., LEMIĆ J., JAŠOVIĆ B. (2005): The effects of feeds based on natural zeolite on production results for fattening lambs. Biotechnology in Animal Husbandry, vol. 21, br. 5-6, str. 49-52.
- STOJKOVIĆ J. (2006): Mineral substances in animal feed. Monograph. Niš.

STOJKOVIĆ M., GRUBIĆ G., ADAMOVIĆ M., MEKIĆ C., ORLOVIĆ JELENA (1999): The influence of zeolite on the important production results in fattening lambs. Collection of scientific papers, 5, 489-495.

SHARIATMANDARI F. (2008): The application of zeolite in poultry production. Worlds Poultry Science Journal, 64, 76-84.

Received 25 June 2012; accepted for publication 10 August 2012