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INFLUENCE OF MIN-A-ZEL PLUS AND MAIZE MEAL ADDITION ON THE QUALITY OF LUCERNE SILAGE

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Abstract: The influence of mineral adsorbent Min-A-Zel Plus (5 g/kg) and maize meal (25 and 50 g/kg) used alone or combined, on chemical composition, biochemical changes and quality of lucerne silage was investigated.

Based on the obtained data, it can be concluded that addition of Min-A-Zel Plus reduces aminogenesis, while the use of maize meal alone or with zeolite favorable conditions are achieved for lactic acid fermentation, so that the quality of obtained silages is better by one quality class. To achieve better effects of silage quality, the use of combination of mineral adsorbent with carbohydrate additives is recommended.

Key words: lucerne, silage, Min-A-Zel Plus, maize meal.

I n t r o d u c t i o n

The big problem in silage use may be mycotoxicosis, the result of mould activity in silages. Moulds are mostly aerobic organisms and they occur in places with residual oxygen or where air penetrated into silage (K o l j a j i ć et al., 1997). With the good pressure and cover of silage this problem is usually solved. However, some parts of silage are more exposed to moulds, mostly surface layers and portions of silage near the silo-object wall. Also, silage made from more mature material (whole plant maize silage) or haylage is hard to compress due to

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their elasticity, and mould problem is bigger in that silage type. Because of these problems many investigations are done in order to obtain suitable silage additives that would restrict or completely avoid mould development and production of their toxic and carcinogenic metabolites – mycotoxins. In our country the investigation of mineral adsorbents – zeolites as additive in silage production has been continuing during the past few years (Adamović et al., 2001; Koljajić et al., 2003; Grubić et al., 2003; Djordjević et al., 2003-a,b). It is well known that due to their high adsorptive ability zeolites were first used to bind ammonia in intensive agriculture. In practice they are used more and more as additives in complete concentrate mixtures for domestic animals, as prevention to possible mycotoxicosis. On the basis of obtained domestic results, a dose of 0.2% zeolite is recommended for the whole plant maize silage, while investigations which would more precisely define necessary dose for lucerne silage, which is hard to ensile, are going on.

Material and Method

A total of six treatments with three repetitions was made to investigate the influence of zeolite (5 g/kg) and maize meal (25 and 50 g/kg), used alone or combined, on chemical composition, biochemical changes and quality of lucerne silage. Statistic model of the experiment was a randomized plan with triplicates of every treatment. The used lucerne was of second cut in the flowering phase. Used zeolite was organically modified mineral adsorbent Min-A-Zel Plus produced in ITNMS Institute, Belgrade.

Lucerne ensiling was done after a short wilting. Wilting was done under the cover without the influence of rain. Ensiling was done in laboratory siloses, the mass was covered with PVC foil, weight and was hermetically closed. After fermentation the samples of silage were collected and analyses of chemical composition, silage quality and protelysis were done in the Laboratory of the Department of Physiology and Nutrition of Domestic Animals at the Faculty of Agriculture, Zemun (AOAC, 1984). Silage quality was evaluated with DLG method. Statistical analysis of data was done according to the randomized experimental plan (Stanković et al., 1990).

Results and Discussion

The moisture content in silage was done with the drying method at 105°C. It was corrected to include volatile substances that are part of the organic matter (ammonia, acetic and butyric acid). The appropriate coefficients were used for dry matter correction (Djordjević et al., 2003-c). Considering that wilted material was used all silages had increased dry matter content (Table 1), which also had

influence on pH values (Table 2). On treatments where zeolite was added the significant increase of dry matter content was observed.

T a b. 1. - Chemical composition of the starting material and silages

Parameters	Investigated parameters, g/kg DM					
	Corrected DM, g/kg	Crude protein	Crude lipids	Crude fibre	NFE	Ash
Starting material	296.03	202.56	71.57	268.94	346.15	110.78
Silages						
Lucerne without additives	285.01 c	186.24 b	83.72 b	270.40 a	344.48 a	115.26 a
Lucerne + 5 g/kg zeolite	288.34 c	196.11 a	94.74 a	273.22 a	315.13 b	120.80 a
Lucerne + 25 g/kg maize meal	297.84 b	188.69 b	87.66 ab	269.68 a	347.72 a	106.25 b
Lucerne + 5 g/kg zeolite + 25 g/kg maize meal	301. 26 b	195.17 a	81.07 b	256.63 b	354.18 a	112.33 ab
Lucerne + 50 g/kg maize meal	299.21 b	192.43 ab	90.21 a	270.80 a	341.39 a	105.17 b
Lucerne + 5 g/kg zeolite + 50 g/kg maize meal	317.92 a	195.09 a	91.50 a	261.41 b	342.66 a	109.34 b

a,b,c – values in the same column with different letters are statistically different ($P<0.05$)

The amount of crude protein was also significantly variable between different treatments. The reason for this was the loss of ammonia during the silage drying and the influence of additives on the change of relative ratio within chemical constituents. The higher percentage of crude lipids in silages compared to starting material is the result of extraction of the part of lactic acid (which is non-volatile) with diethyl ether (Barnett, 1954). With the simultaneous addition of zeolite and maize meal the significant decrease of crude fiber content. The lowest content of NFE was observed on treatment with only zeolite added, which is a result of much smaller ash content in maize compared to lucerne.

Regardless of the significant variation in pH values of silages, all observed values are very high (Table 2). It is a result of high dry matter content and wilting but also of high buffering capacity of *Fabaceae* plants.

The amount of ammonia nitrogen was highest in control silage and according to Dulphy and Demarquilly (1981) it is characteristic (class III) for silage of acceptable quality (120-150 g/kg N). The lower degree of aminogenesis in treated silages can be explained by the high adsorptive ability of Min-A-Zel-a Plus, but also by fermentation stimulation with carbohydrate additive. Silages that were treated both with zeolite and maize meal had decreasing trend in aminogenesis degree, but not statistically significant. On the basis of ammonia nitrogen content, all treated silages were according to Dulphy and Demarquilly (1981) classed one class higher (class II). The pH values and the dry matter content are the most

important factors that influence proteolysis, but they cannot stop it completely (Carpintero et al., 1979).

T a b. 2. - Parameters of biochemical changes in lucerne silages

Treatments	pH	NH_3-N, g/kg ΣN	Acids, g/kg DM						
			Lactic	Acetic			Butyric		
				F	B	T	F	B	T
Lucerne without additives	4.84 bc	152.11 a	43.38 b	10.87 b	44.36 a	55.23 a	-	-	-
Lucerne + 5 g/kg zeolite	4.91 b	106.25 b	41.41 b	9.79 b	37.13 ab	46.92 b	-	-	-
Lucerne + 25 g/kg maize meal	4.74 c	117.50 b	57.88 a	15.39 a	30.45 b	45.84 b	-	-	-
Lucerne + 5 g/kg zeolite + 25 g/kg maize meal	5.03 a	107.92 b	51.19 a	7.23 c	24.32 c	31.65 c	-	1.91	1.91
Lucerne + 50 g/kg maize meal	4.90 b	116.70 b	57.82 a	8.20 c	24.42 c	32.62 c	-	4.35	4.35
Lucerne + 5 g/kg zeolite + 50 g/kg maize meal	4.88 b	114.06 b	54.18 a	11.19 b	23.97 c	35.16 c	-	-	-

a.b.c – values in the same column with different letters are statistically different (P<0.05)
F- free; B-bonded; T-total

The control silage and treatment with 5 g/kg zeolite had significantly lowest lactic acid content. With the inclusion of maize meal the increase of lactic acid production was observed. Contrary to that, with the combination of zeolite and maize meal, or with higher amount of meal alone the significantly more acetic acid was produced. This may be explained by bactericide effects of lactic acid. In spite of that, treatments with 5 g/kg zeolite + 25 g/kg maize meal or only with 50 g/kg maize meal had butyric acid. However, butyric acid was present in bonded form. Also bonded form of acetic acid was dominating compared to free form and possible explanation is the high content of mineral matters, especially calcium, in lucerne.

T a b. 3. - Evaluation of silages by DLG method

Treatments	Relative acid ratio, %			Number of points	Quality class
	Lactic	Acetic	Butyric		
Lucerne without additives	43.99	56.01	0.00	31	III
Lucerne + 5 g/kg zeolite	46.88	53.12	0.00	34	III
Lucerne + 25 g/kg maize meal	55.80	44.20	0.00	41	II
Lucerne + 5 g/kg zeolite + 25 g/kg maize meal	60.40	37.35	2.25	42	II
Lucerne + 50 g/kg maize meal	61.00	34.41	4.59	42	II
Lucerne + 5 g/kg zeolite + 50 g/kg maize meal	60.64	39.36	0.00	43	II

Silages were evaluated by DLG method based on pH values and relative ratio of lactic, acetic and butyric acid (Djordjević and Dinić, 2003). The control silage and the one with 5 g/kg zeolite had dominating acetic acid fermentation and were ranked as class III quality (Table 3). With the use of maize meal alone or combined with zeolite the lactic acid fermentation was favourized and these silages were ranked as one class better.

Conclusion

With the use of commercial mineral mycotoxine adsorbent Min-A-Zel-Plus in silage production the reduction of aminogenesis was observed, while with the use of maize meal alone or combined with zeolite the lactic acid fermentation was augmented and the silage quality was better by one class. In order to obtain better effects on lucerne silage quality, it can be recommended to combine that mineral adsorbents based on zeolite with carbohydrate additives.

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UTICAJ DODAVANJA MIN-A-ZEL-a PLUS I KUKURUZNE PREKRUPE NA KVALITET SILAŽA LUCERKE

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R e z i m e

U radu je ispitivan uticaj mineralnog adsorbenta Min-A-Zel-a Plus (5g/kg), i kukuruzne prekrupe (25 i 50 g/kg), korišćenih pojedinačno ili u međusobnim kombinacijama na hemijski sastav, biohemijske promene i kvalitet silaža lucerke. Statistički model ogleda je bio slučajan plan a svaki tretman je rađen u tri ponavljanja.

Na osnovu utvrđenih podataka zaključuje se da dodavanjem Min-A-Zel-a-Plus dolazi do redukcije aminogeneze, a pri korišćenju kukuruzne prekrupe u čistom vidu ili u kombinaciji sa zeolitom do favorizovanja mlečnokiselinskog vrenja i postizanja kvaliteta silaža boljeg za jednu klasu. U cilju postizanja većeg efekta na kvalitet silaže preporučuje se kombinovanje mineralnih adsorbenata na bazi zeolita sa ugljenohidratnim dodacima.

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