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The Quality of Grass Silage and Haylage on Farms in Bosnia and Herzegovina

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Abstract

The aim of this research paper was to determine the value of grass silage and haylage on farms for milk production in Bosnia and Herzegovina, and on the basis of a result analysis to make recommendations for improving the quality of forage and for feeding dairy cows. We analysed samples of grass silage from 10 farms and haylage samples from 17 farms having more than 20 dairy cows in the herd. The following parameters of grass silage and haylage were determined: the degree of acidity (pH), dry matter (DM), crude protein (CP), crude cellulose (CC) and mineral matter (MM). The results show a satisfactory level of average pH values (4.76 grass silage, 5.33 haylage), a satisfactory level of DM (29.80% grass silage, 48.26% haylage), low content of CP (grass silage, 11.66%; 12.69% haylage), high content of CC (43.36% grass silage, 42.03% haylage), low content of MM (2.22 grass silage, 2.05 haylage). The results show large variations in all the tested quality parameters. pH value of silage ranged from 3.74 to 5.92, and for haylage from 4.65 to 6.37; DM grass silage 19.10 to 29.80 and haylage from 37.84 to 64.13; CP grass silage from 6.55 to 18.34 and haylage from 7.36 to 24.36; CC grass silage 23.87 to 57.34 and haylage from 25.76 to 63.76; MM grass silage 1.54 to 2.87 and haylage from 2.10 to 2.87.

Key words: haylage, grass silage, protein, cellulose, dry matter, mineral matter

Introduction

The quality of grass silage and haylage varies depending on the applied agricultural techniques, silage technology, weather conditions, but phyto phenological maturity of the meadows when mowing has the most significant effect. The main factors affecting the quality of silage and haylage with postponing the deadline of grass

mowing for silage mass are chemical composition, fermentation quality, ad libitum intake and digestibility.

According to American standards (AFGC - American Forage and Grasslands Council), a class of excellent clover silage includes grass and clover mixture mowed early (1/4 flowering or early flowering stage) that fades before being placed in silos or silo with preservative (molasses or cereal grains).

In the vegetative stage of plant development, the share rate of leaf is equal to or higher than share rate of the stem, while with ageing of the lawn the share of leaf mass reduces and the relative proportion of stem increases. Furthermore, the amount of crude protein decreases, and the amount of crude fibre increases (Di Marco et al., 2002).

Lower forage quality is associated with increased lignin and structural parts of the cell wall or the reduction of crude protein and digestible parts of the plant cells, such as starches, monosaccharides and sucrose (Aman & Lindgren, 1983).

Feeding production animals with grass silage only can be similar to the diet of fresh grass, as delaying mowing service and poor technique of ensiling grass silage mass provide poor nutritional value and low consumption (Aston et al., 1994).

The value of an ingredient in animal feed is the concentration of nutrients per unit of dry matter and the amount of forage an animal can consume. There is a negative correlation between moisture content and consumption of forage dry matter (Steen et al., 1998) and positive correlation between the digestibility of grass silage in dairy cows fed ad libitum and milk production (Castle, 1975).

Production potential and body weight of cows, the amount and type of concentrate feed and protein supplements influence on consumption of dry matter silage most (Chamberlain et al, 1989).

Saving high quality grass silage and haylage requires intensive cropping and more mowing, which has an impact on the price of hay and silage, but increased production costs are justified by better quality grass silage and haylage.

The most common way of storing hay and silage is in the silo pit (which is the cheapest), while only 4 farms prepare grass silage and haylage in the rolling bales. According to research in the EU storing silage and haylage, bale rolling is the most expensive way of saving roughage.

Materials and methods

The study includes samples of grass silage from 10 farms and silage samples from 17 farms (Una-Sana Canton, Banja Luka, Kozarska Dubica, Prnjavor, Bijeljina, Bratunac, Modriča, Tuzla Canton, Posavina) of major milk producers who run production with more than 20 dairy cows. Samples were delivered to the laboratory of the Agricultural Institute Bihać.

The chemical quality of grass silage and haylage samples was determined with the following methods:

- pH value - using a pH meter (sample in distilled water);

- Protein - (sample preparation, digestion, distillation, titration), apparatus by Kjeldhal;
- Cellulose – Method of manufacturers (VELP) - extractor for cellulose;
- Moisture (dry matter) - Automatic Hygrometer (OHAUS);
- Minerals - method of burning and annealing (burner and furnace annealing).

Survey results were analysed in SPSS 12 statistical programme (Statistical Package for the Social Sciences).

Results and discussion

The average pH value is within optimal values of acidity silage.

The low level of proteins and a high level of cellulose is one of the indicators of later grass cutting and ensiling. Mowing at later phyto phenological stages of development decreases the protein content and increases cellulose content.

Tab. 1. Chemical composition samples of grass silage
Hemijski sastav uzoraka travne silaže

No. Br.	pH	Crude protein *Sirovi protein %*	Crude cellulose *Sirova celuloza %*	Min. Matter *Min. materije %*	Dry matter *Suva materija %*
1	5.06	16.31	26.46	2.08	39.60
2	5.92	9.50	42.16	2.34	37.23
3	4.54	12.94	48.00	2.06	25.23
4	3.74	8.71	49.40	2.04	32.03
5	5.40	18.34	23.87	1.54	21.42
6	4.64	11.24	43.41	1.87	28.57
7	4.15	6.55	50.93	2.51	19.09
8	4.13	7.36	43.02	2.57	26.71
9	4.99	9.22	49.06	2.32	30.29
10	5.08	16.47	57.34	2.87	37.84

Tab. 2. Descriptive Statistics - grass silage
Deskriptivna statistika – travna silaža

	N	Minimum	Maximum	Range *Obim*	Mean *Srednja*	Std. Deviation *Stand. odstupanje*
pH	10	3.74	5.92	2.18	4.765	0.65595
Crude protein *Sirovi protein*	10	6.55	18.34	12.42	11.664	4.15157
Crude cellulose *Sirova celuloza*	10	23.87	57.34	33.47	43.365	10.59494
Min. matter *Min. materije*	10	1.54	2.87	1.33	2.22	0.38239
Dry matter *Suva materija*	10	19.09	39.60	20.51	29.801	6.97594

Great difference in the protein content (max. 18.34) indicates a different mowing period and different proportion of legumes in the mass.

The low level of minerals is an indication of weak supply of land and insufficient fertilisation. Great difference in the content of dry matter is an indication that the grass silage was prepared without wilting in the early stages, while a high level of solids is an indication of late mature lawn mowing.

Tab. 3. One-Sample T – Test – grass silage
T –test jednog uzorka – travna silaža

	t	df	Sig. (2-tailed) *Znač. (dvostranost)*	Mean difference *Srednja razlika*	Mean *Srednja*	95% Confidence Interval of the Difference *95% interval sigurnosti razlike*	
						Lower *Donji*	Upper *Gornji*
pH	22.972	9	0.000	0.20743	4.765	4.2958	5.2342
Crude protein *Sirovi protein*	8.885	9	0.000	1.31284	11.664	8.6941	14.6339
Crude cellulose *Sirova celuloza*	12.943	9	0.000	3.35041	43.365	35.7858	50.9442
Min. Matter *Min. materije*	18.359	9	0.000	0.12092	2.220	1.9465	2.4935
Dry matter *Suva materija*	13.509	9	0.000	2.20599	29.801	24.8107	34.7913

Tab. 4. Chemical composition of haylage samples
Hemijski sastav uzoraka silaže

No	pH	Crude protein *Sirovi protein*%	Crude cellulose *Sirova celuloza* %	Min. matter *Min. materije* %	Dry matter *Suva materija* %
1	5.88	7.37	63.76	1.86	53.66
2	5.61	14.95	43.63	1.97	46.67
3	5.18	16.29	36.92	2.65	42.05
4	5.35	10.94	59.94	2.23	61.43
5	5.71	11.78	31.42	2.71	57.95
6	5.41	8.75	32.35	2.3	41.41
7	4.87	24.36	25.76	2.14	45.9
8	5.31	8.98	40.74	2.23	44.59
9	5.54	16.94	29.54	1.38	50.56
10	4.96	12.61	38.74	1.88	55.81
11	5.49	8.58	44.8	1.34	46.03
12	4.93	11.21	29.96	1.45	48.34
13	5.07	7.72	41.17	2.04	64.13
14	5.27	12.4	29.41	1.43	39.26
15	6.37	17.43	45.31	2.76	45.13
16	4.65	8.95	63.71	1.69	39.74
17	5.08	16.47	57.34	2.87	37.84

The average pH of the analysed silage samples is satisfactory, in accordance with the table values.
The low level of proteins and high levels of cellulose indicates mowing in the later stages ofphyto phenological development.

A large variation in the protein contents suggests mowing at different stages of development as well as the different proportion of legumes in mixtures.
Low mineral matter content is an indicator of poor fertilisation and non-application of appropriate management systems.
A large variation in the contents of dry matter suggests mowing at different stages and that haylage mass wilted at different times.

Tab. 5. Descriptive Statistics – haylage
Deskriptivna statistika - silaža

	N	Minimum	Maximum	Range *Obim*	Mean *Srednja*	Std. Deviation *Stand. odstupanje*
pH	17	4.65	6.37	1.72	5.334	0.41912
Crude protein *Sirovi protein*	17	7.37	24.36	16.99	12.69	4.53057
Crude cellulose *Sirova celuloza*	17	25.76	63.76	38.00	42.03	12.47409
Min. Matter *Min. materije*	17	1.34	2.87	1.53	2.10	0.50035
Dry matter *Suva materija*	17	37.84	64.13	26.29	48.26	7.88452

Tab. 6. One-Sample T – Test – haylage
T –test jednog uzorka –silaža

	t	df	Sig. (2-tailed) *Znač. (dvostranost)*	Mean difference *Srednja razlika*	Mean *Srednja*	95% Confidence Interval of the Difference *95% interval sigurnosti razlike*	
						Lower *Donji*	Upper *Gornji*
pH	52.474	16	0.000	0.10165	5.33412	5.1186	5.5496
Crude protein *Sirovi protein*	11.549	16	0.000	1.09822	12.69000	10.3606	15.0194
Crude cellulose *Sirova celuloza*	13.892	16	0.000	3.02541	42.02941	35.6158	48.4430
Min. Matter *Min. materije*	16.932	16	0.000	0.10192	2.05471	1.7974	2.3120
Dry matter *Suva materija*	25.239	16	0.000	1.91228	48.26471	44.2109	52.3186

Conclusion

Agricultural producers can produce high-quality grass silage and haylage. Currently one of the biggest problems in storing silage and haylage in Bosnia and Herzegovina is the lack of adequate and modern agricultural machinery for storing hay and silage.

The analysed samples indicate that mainly grass silage and haylage is saved at phyto phenological stages of development. The prevailing opinion among farmers is that it is better to have a higher yield mass per unit area and not how much milk they may get from the specific area or how to produce protein and energy from the specific area.

Some of the results of the analysis show a very satisfactory relationship between grass and legume mixture. People increasingly practice silage and haylage from legumes themselves, which, if allowed to be ready at appropriate stages of development, will give a very good quality.

Also, on a small number of farms, there is a trend of two harvests a year (fall - vetch and rye silage and in the spring - corn silage).

Ongoing education and the presence of agronomists in the field are necessary in order to improve the quality of silage and haylage.

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Kvalitet travne silaže i sjenaže na farmama u Bosni i Hercegovini

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Sažetak

Cilj istraživanja je utvrditi kvalitet travne silaže i sjenaže na farmama za proizvodnju mlijeka u Bosni i Hercegovini, te na osnovu rezultata analiza dati preporuke za poboljšanje kvaliteta krme i preporuke za ishranu muznih krava. Analizirani su uzorci travne silaže sa 10 farmi i uzorci sjenaže sa 17 farmi koje imaju više od 20 muznih grla u stadu. Utvrđivani su sljedeći parametri kvaliteta travne silaže i sjenaže: stepen kiselosti (pH), suha materija (SM), sirovi protein (SP), sirova celuloza (SC), mineralne materije (MM). Rezultati analiza pokazuju zadovoljavajući nivo prosječne pH vrijednosti (travna silaža 4,76; sjenaža 5,33), zadovoljavajući nivo SM (travna silaža 29,80%; sjenaža 48,26%), nizak sadržaj SP (travna silaža 11,66%; sjenaža 12,69%), visok nivo SC (travna silaža 43,36%; sjenaža 42,03%), nizak nivo MM (travna silaža 2,22; sjenaža 2,05). Rezultati analiza pokazuju velike varijacije svih ispitivanih parametara kvaliteta. pH vrijednost travne silaže varirala je od 3,74 do 5,92, a sjenaže od 4,65 do 6,37; SM travne silaže od 19,10 do 29,80 a sjenaže od 37,84 do 64,13; SP travne silaže od 6,55 do 18,34 a sjenaže od 7,36 do 24.36; SC travne silaže od 23,87 do 57,34 a sjenaže od 25,76 do 63,76; MM travne silaže od 1,54 do 2,87 a sjenaže od 2,10 do 2,87.

Ključne riječi: sjenaža, travna silaža, bjelančevine, celuloza, suha materija, mineralne materije

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