

MONITORING QUALITY OF HAY ON FARMS FOR MILK PRODUCTION IN NORTHERN BOSNIA AND HERZEGOVINA

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Abstract

The goal of the research was to monitor the quality of hay on farms in the period from 2008. to 2012. year, and to compare the quality of hay by years of research. The analyzed samples of hay from 41 farms are from low to medium quality (low protein content, high cellulose content, low content of mineral matter), probably mowed in later stages of development of lawn maturity than recommended for the production of high quality hay to feed dairy cows. The medium value of crude protein by years of research is in 2008 – 15.62 %, 2010 – 9.39 % and in 2012th was 11.57 %. The low level of protein indicates a bad choice of grass and clover-grass mixture for sowing and preparation at a later stage of grass and mixture growth. Minimum content of crude protein is 4.54 %, maximum is 18.56 %. The medium value of crude cellulose by years of research is in 2008th 41.49 %, 2010 – 43.82 % and in 2012 – 43.13 %. The high content of cellulose is an indicator of preparation of hay in later stage of grass and mixture growth. Minimum content of crude cellulose is 25.24 %, maximum is 66.07 %. Moisture content, the medium value by years of the research is in 2008 – 85.58 %, 2010 – 86.40 % and in the 2012 – 86.58 %. The medium value of mineral matter by years of research is in 2008th 2.7 %, 2010 – 2.11 and in 2012 – 2.07 %.

Key words: *hay, protein, cellulose, moisture, mineral matter*

Introduction

High milk production can only be achieved with quality livestock forage because the type and quality of forage affect the quantity and composition of milk (Caput, 1996).

Hay is characterized by low concentrations of digestible nutrients and a large amount of ballast that make indigestible organic matter (Kalivoda, 1990).

Hay can be visually evaluated taking in account the stage of maturity at the time of mowing, the purity of color and scent. Chemical parameters associated with the consumption and quality of hay are energy value of feed (Bll et al., 2002), fiber content, protein and dry matter (Cherney and Martens, 1998).

There are many factors that determine the quality of hay (species and varieties of grasses and / or legumes, soil fertility, climate, season, relation of stems and leaves, thickness of stems, weeds, weather conditions at harvest, storage technologies and storage), but the most important factor is the stage of maturity of grass / legume at the time of mowing. Delaying the harvest time from the vegetative stages of development of grasses and legumes to reproductive (seed formation) is increasing cellulose content and reducing protein content, digestibility and forage intake.

According to Hoveland et al. (1997) delaying of lawn mowing for four weeks, in the hay is reduced the protein content for 4 to 6%, and digestibility of organic matter in the dry matter for 13%.

The forage quality decline by delaying of mowing time has been connected with an increased proportion of lignin and structural parts of wall of the cell, or reduction in content of protein and digestible parts of the plant cell, such as starch (Aman and Lindgren, 1983)

In the vegetative stage of plant development, leaf share is larger than the stem share, while the aging of turf reduces the share of leaf, and relatively increases proportion of stems, ie. the amount of crude protein decreases and the amount of crude fiber is increasing (Di Marco et al., 2002).

The average cow can eat easily (if fed only with hay):

- About 12 kg of low quality hay from which, with surviving needs, she gets 2.2 liter of milk;
- About 15 kg of high quality hay from which, with surviving needs, she gets 15.3 liters of milk.

Increasing of cellulose amounts affects digestibility of feed, energy content and potential consumption decreases, which directly affects the production of milk. In parallel with the quality decrease, digestibility of feed and drinking at will reduces, so it is necessary to provide nutrition with other fodder in order to meet the nutritional needs of highly productive animals.

Hay production prevails in the preparation of forage feed from the lawn. Production of alfalfa hay is conditioned by the impossibility of alfalfa production on acid soils that dominate in this area. As a possible solution it is found the production of red clover, which tolerates better acid soils than alfalfa.

One of the problems is applied agro-technique measurements on artificial meadows and pastures. When establishing meadows and pastures most farmers performs spring sowing, without plowing of fertilizer, and also the usage of manure is reduced. All these factors are leading to low yields of green mass and hay as well as the poor quality of the produced animal feed.

The introduction of new forage crops such as field peas, beans and other legumes goes very difficult. Lolium (ryegrass) is predominant grass.

Production of clover-grass mixtures happens on small surfaces. Main reason for low production of clover-grass mixtures is lack of production technology. Most farmers highlight problems of maturing grass and clover in a different period, which creates a dilemma about mowing time. Regardless such opinion of farmers, preparation of hay is done in the later growth stages for reasons of higher yields, because farmers from BiH have prevailing opinion that more important is forage yield, not quality. Number of cuts is two to three per year, which is, as compared to some neighboring countries, very low number. In order to improve this aspect of forage production, a number of experiments have been done for production of red clover and the clover-grass mixtures.

Materials and Methods

The survey included hay samples from 30 farms. The surveyed farms have more than 10 dairy cows. Samples were analyzed by the Agricultural Institute of Una-Sana Canton.

The chemical quality of the hay samples was determined by following methods:

- Protein (nitrogen) - (sample preparation, digestion, distillation, titration), apparatus by Kjeldhal procedure;
- Cellulose- manufacturer's method (VELP) – cellulose extractor;
- Humidity (dry matter) - automatic moisture device (Ohaus);
- Minerals- method of burning and annealing (burner and furnace annealing).

Based on the results of analysis, consultants from the Republika of Srpska Extension Services Agency, Agricultural Institute of Una-Sana Canton and Agricultural Institute of Tuzla Canton, developed recommendations on the hay feeding procedure for dairy cows.

Data were analyzed using SPSS 12 statistical program.

Results and Discussion

Table 1. The crude protein content (%)

	2008	2010	2012
min	11,62	5,52	4,54
max	18,43	15,83	18,56
Average	15,624	9,389	11,57

Table 2. F – test of crude protein content

DEVIATION			d.f.	Variation	Analysis			
					F		d.f.	
Source of Variation	Amount	%			Calc.	Tab.	More	Less
Between mean treatments	560,5658	42,82	2	280,2829	30,32361	3,15	2	81
Residual or sample errors	748,69	57,18	81	9,24306				
Total	1.309,25	100	83					

Statistically there is a significant difference in the content of crude protein by years of research, and as a major factor in the differences of crude protein are agro climatic conditions of production. Results show a high average content of crude protein in tested of hay samples from 4.54 % to 18.56 %.

Table 3. Crude cellulose content (%)

	2008	2010	2012
min	38,54	25,24	29,17
max	45,87	66,07	64,96
Average	41,49	43,82	43,13

Table 4. F – test of crude cellulose content

DEVIATION			d.f.	Variation	Analysis			
					F		d.f.	
Source of Variation	Amount	%			Calc.	Tab.	More	Less
Between mean treatments	80,1434	1,65	2	40,0717	0,681837	3,15	2	81
Residual or sample errors	4.763,53	98,35	81	58,80898				
Total	4.843,67	100	83					

Results show a high average content of cellulose in tested of hay samples from 25.24 % to 66.07 %. The cause of the high content of cellulose of the prepared silage is agro-climatic conditions of production. Statistically, there is a significant difference in terms of cellulose content by years of research.

Table 5. The moisture content

	2008	2010	2012
min	13,02	9,6	8,26
max	16,45	25,85	17,89
Average	14,42	13,6	13,42

Table 6. F – test of moisture content

DEVIATION			d.f.	Variation	Analysis			
					F		d.f.	
Source of Variation	Amount	%			Calc.	Tab.	More	Less
Between mean treatments	15,91695	3,62	2	7,958475	1,522266	3,15	2	81
Residual or sample errors	423,4718	96,38	81	5,228046				
Total	439,3887	100	83					

The fortified average moisture content ranged from 8.26% to 25.85 %. It is not noticed a statistically significant difference in moisture content.

Table 7. The mineral matter content

	2008	2010	2012
min	1,83	0,93	1,27
max	3,87	3,56	3,87
Average <i>Prosjek</i>	2,7	2,11	2,07

Table 8. F – test of mineral matter content

DEVIATION			d.f.	Variation	Analysis			
					F		d.f.	
Source of Variation	Amount	%			Calc.	Tab.	More	Less
Between mean treatments	6,965193	21,59	2	3,482596	11,14933	3,15	2	81
Residual or sample errors	25,3011	78,41	81	0,312359				
Total	32,26629	100	83					

The determined average mineral matter content from 0.93% to 3.87% .

Conclusion

The analyzed samples of hay from 41 farms are from low to medium quality (low protein content, high cellulose content, low content of mineral matter), probably mowed in later stages of development of lawn maturity than recommended for the production of high quality hay to feed dairy cows.

Statistically we determined significant differences in the quality of the hay.

To ensure the quality of the hay it is necessary to do the following:

- Chemical analysis of soil every 4-5 years,

- Ameliorative fertilization + calcification every 4 or 5 years, based on the chemical analysis of soil. Soil fertility at least 16 - 18 mg of phosphorus and potassium in the soil + sufficient amount of calcium,
 - Processing and preparation of land for sowing + fertilization of current production, - pre-sowing fertilization; plowing of 2/3 NPK fertilizer to get to the bottom of the furrow, and disking of 1/3 NPK
 - Mineral fertilizer for top dressing - NPK 10:20:30 2/3 in autumn + 1/3 at the end of February and early March and KAN for feeding before the start of the vegetation season and after each grass swath
 - Timely sowing and purchase of grass or alfalfa seeds
 - Mowing the green mass in the earlier stages of maturity and transportation to the barn.
- Recommendation is: mowing and preparing of mown mass for haylage or hay, 4-6 swaths. Hay no more than 10%, while lawn should be used for preparation of haylage or silage in silos.

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