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EFFECT OF DIFFERENT HAYLAGE LINES ON HAYLAGE CHEMICAL COMPOSITION

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Abstract

Haylage is obtained by combining the process of making hay and silage. Green mass is dried in the air, so that the moisture content drops to 40-50 %. After that, dried mass undergoes fermentation in sealed towers, or other silo - objects. Making of haylage presupposes the use of such silo - spaces, which completely prevent the presence of air. The main objective in this study is whether the way of making haylage can affect the quality of received silage. Since all processes in the production of haylage are mechanized, it's understandably potentiation of proper and economical choice of making haylage. Basically, the assessment is based on the results of the organoleptic and chemical analysis, including the share of legumes, protein, cellulose, etc. Our research was based on the data obtained in chemical analysis of samples of haylage from Silo-trenches and haylage in wrapped bales. The following parameters is determined: moisture content, crude protein, crude fat, crude fiber and starch. Obtained silage quality is on the satisfactory level with moisture content from 51.46 to 52.45 %, crude protein from 4.82 to 5.57 % and the results showed very little variation in the chemical composition of both lines of preparing haylage.

Keywords: *self-loading trailer, roll baler, haylage, grass silage, protein, dry matter*

Introduction

Haylage is obtained by combining the process of making hay and silage . Green mass is dried in the air, so that the moisture content drops to 40-50 % . After that, dried mass undergoes fermentation in sealed towers, or other silo - objects (Obradovic, 1976). Haylage represents the closest replacement for green animal feed and today is the basis of cost-effective and modern animal husbandry. The quality of grass silage and haylage varies depending on the applied agricultural techniques and technology, weather conditions, the composition of the meadows and the most important thing, the phenological phases of the material, ie. given meadows.The main factors affecting the quality of silage and haylage are moisture content, phenological stage in which the plants are at the moment of mowing, the mass of sugar in the material that is ensiled and anaerobic environment during the ensiling process. Delaying the time of mowing grass for haylage directly affects the chemical composition, the quality of the fermentation, and the quality of the silage and its digestibility and intake of the animals themselves. Except for biological factors mentioned above, one of the important factors is the method of applying the ensiling grass mass.

Haylaging represents a more successful method of preservation green fodder than drying of hay in a natural way. Haylage has many advantages over the hay, first and foremost, is that storing silage preserves leaves as the best parts of plants. Proces of making silage considerably lessens nutritient losses than the traditional method of storing hay. Also, when storing silage losses are negligible around 5%, while losses in hay making 25 - 40%, and sometimes higher. Conservation biomass by haylaging is in full implementation of mechanization starting from the cutting and storing, preparation and distribution of farm

animals in the stable. Haylage as animal fodder contains more than twice dry matter content, and animals consume it in larger quantities in relation to the silage. Less water in the nutrients, also reduces the cost of transportation to the stable, and is more economical than storing silage. Preparation of haylage requests significantly lower costs compared to storage of hay especially when loading and transport of feed to the stable are mechanized.Conservation of biomass by storing the haylage consists of the ensiling process, and dried in the air, so that the moisture content drops to 40-55 % of humidity.

The main objective in this study is to determine whether the way of making haylage can affect the quality of received silage. Since all processes in the production of haylage are mechanized, it's understandably potentiation of proper and economical choice of making haylage. Plants for haylaging significantly range (in sugar content and buffer capacity). According to the presence of sugar and ensiling ability, green plants are classified into three groups: plants that are easily ensilaged, second which are difficult to ensiled and third plants that can't be ensiled alone (Čobić et al., 1983). The principle of ensiling is based on the transformation of water soluble carbohydrates, which must transformed at least 10% of the dry matter in lactic acid. This is achieved in an anaerobic environment, by work of anaerobic lactic acid bacteria, and other microorganisms, with adequate moisture, 65-70% in forages and 33-38% in the concentrated feed (Dinić and Djordjevic, 2005) and temperature (35-38^{0}C). For these reasons it is recommended drying of cutted biomass of grasses and legumes in order to achieve optimum moisture. Drying requires greater involvement of mechanization and workforces, because the first pass requires mowing the plants for haylaging, and the second collecting them into larger windrows and picking them up and choping them up using silo–combine. The procedure of making, haylage is the most appropriate replacement of green fodder, because the modern approach of storing forage achieves the highest degree of preservation of the quality and nutritive value of forages, which has the particular importance to the savings in additional animal nutrition with expensive concentrated feeds. As such it is used for feeding ruminants during the whole (or at least half) year. Making of haylage in a bales wrapped with stretch foil is the best way of storing haylage. The quality of haylage is determined keeping in mind chemical, biological and nutrient values including: dry matter content (DM), organic matter content (OM), crude proteins (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), methabolic energy value (ME), pH, content of products of fermentation (lactic acid, volatile fatty acids), content NH_3-N (Vranić et al., 2005). It is desireable for haylage to have more than 300 g kg^{-1} DM, more than 11 MJ kg-1 SM ME, more than 70% metabolic energy (FME/ME), 150-175 g SP kg^{-1}SM, pH value 4,0-4,5, 500-550 g NDF kg^{-1}SM, less than 50 g kg^{-1} SM nitrogen in form of NH_3-N, more than 100 g residue sugar kg^{-1}SM, 80-120 g lactic acid kg^{-1} SM (Chamberlain and Wilkinson, 1996). In the vegetative stage of plant developement, leaves percentage is equal or higher to the percentage of stem, while the older meadow gets percentage of leaves is lower, and the stem percentage gets higher, the amount of crude proteins decreases while the amount of crude fiber increases. (Di Marco et al., 2002). The decreasing in quality of mowed mass is connected directly to increasing of lignin and structure parts of cell walls, meaning that decreasing of amount of crude proteins and digestable parts of cells in the plant such as starches, monosaccharides and sucrose (Aman and Lindgren, 1983). In the same time consumption is lowering as well as digestibility.

Materials and methods

There are different methods for determining the quality of haylage. All the methods are based on the results of organoleptic and chemical analysis, including legumes, content of proteins, fiber and so on. Analysis of the haylage samples has been done in the certified laboratory „Sistem Qualita S“ by standard methods AOAC, 2002 for animal fodder analysis. Basic chemical qualities of haylage are determined with folowing methods:
Determining the amount of moisture- drying on 105^0C until constant mass
Determining amount of crude fiber by Kjeldahl method
Determining amount of crude fats by Soxhlet method
Determining amount of crude cellulose by Gerhardt method
Determining amount of starch by polarimethric method
Determining amount of mineral matter by burning it
Determining amount of NFE by calculating it
Determining energy value by chemical composition and energy value of nutritients
Checking to see whether there is significant statistical influence of different production lines on the quality of haylage using diferent mechanical equipment (round bales wraped in strech foil, sillo mass pressed in silo and covered with foil) has been done by standard statistical methods, or testing the hypothesis that the middle values of two different groups are equal. Testing has been done using t-test, or testing the ground hypothesis about a difference between average values of the two groups.

Results and discusion

Chemical composition and nutritive value of haylage are greately influenced by grass to clover ratio, species and types of grass and clover phytophenological maturity of meadows at the time of mowing, technology of preparation (chopping, SM content, adding preservers), supplying the soil with enough nutrients, agricultural practices and climatic factors (temperature, light, precipitation).

Picture 1. Haylage sample from silo

Picture 2. Haylage sample from wrapped bale

Our research, we have based on the data of chemical analysis of samples from silo haylage and bales wrapped in stretch foil.

Table 2: Chemical analysis of haylage samples (%)

Chemical composition and energy value	Way of storing haylage	
	Silo-trenches	Wrapped bales
Moisture, %	51.46	52.45
Ash, %	3.30	4.69
Crude cellulose, %	17.82	18.48
Content of starch, %	0.0	0.0
Crude protein, %	4.82	5.57
Crude fat, %	1.21	1.32
NFE, %	21.39	17.13
Energy value, KJ/100g	429.65	457.69

The lower level of protein and high levels of cellulose is one of the indicators for late mowing and haylaging. Mowing in the later phytophenological stages reduces the protein content and increases the content of cellulose (Glavic at al., 2013) Testing, done using t-test, or testing the ground hypothesis about a difference between average values of the two groups, has shown that machine production line has no greater influence on chemical composition of haylage. These results are similar to the research of Glavic (2013), by comparing the quality of haylage on 10 farms in Bosnia and Herzegovina, level of DM (48.26% haylage), low content of CP (12.69% haylage), high content of CC (42.03% haylage), low content of MM (2.05 haylage).

Table 3: Results of testing on the quality of silage

X_1	X_2	d_i	[illegible]	[illegible]
51.46	52.45	-0.99	2.96	8.79
3.3	4.69	-1.39	2.56	6.58
17.82	18.48	-0.66	3.29	10.85
4.82	5.57	-0.75	3.20	10.27
1.21	1.32	-0.11	3.84	14.78
21.39	17.13	4.26	8.21	67.47
429.65	457.69	-28.04	-24.09	580.12
	[illegible]	27.68		698.86
	[illegible]	3.95		
	t_{exp}= -0.969			

$t_{tab5\%} = 2.45$

$t_{tab1\%} = 3.71$

$t_{exp} < t_{tab} \rightarrow$ accepted H_0

Conclusion

Haylaging is the process of preparing the green mass of animal feed, which provides high quality animal feed, with little loss of dry matter and nutrients (carbohydrates, proteins, vitamins, mineral substances).In the process of preparation the green mass for silage or haylage, all processes can be mechanized starting from mowing, raking, chopping and loading, transportation and unloading of chopped material.

Producing high-quality grass silage and haylage today is not easy. Currently one of the biggest problems in storing haylage in Bosnia and Herzegovina is the lack of adequate and modern agricultural machinery for storing hay and silage. Obtained silage quality is satisfactory, moisture content from 51.46 to 52.45% , crude protein from 4.82 to 5.57% and the results showed very little variation in the chemical composition of both lines of

preparation. After chemical analysis of silage samples and their statistical analysis using the t - test,it can be concluded that the different lines haylage making, or method of storing silage had no greater impact on the quality of the silage. Greater impact is found in phenological phases during mowing process than the production itself.

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