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DETERMINATION OF ENSILING POSSIBILITIES OF *PLANTAGO LANCEOLATA L.*

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Abstract

This study was carried out in order to identify the ensiling ability of plantago and the effect of molasses additives to plantago on some silage quality criteria. In this context 0 % of (control) and 3% of molasses were added to plantago and ensiling period lasted for 60 days. According to the obtained results, with 3 % of molasses additives to plantago, dry matter contents of the silages increased compared to the control group ($P<0.05$). However, no significant difference was identified between the groups in terms of other parameters (OM, HP, NDF, ADF, pH, LA, AA, PA) ($P>0.05$). Butyric acid and ammonia nitrogen contents were not determined in the silages obtained from the plantago. According to sensual analysis results, although odour and total quality properties of the group with 3 % of molasses additives were significantly higher compared to the control group, both groups were identified to be in "Very Good" quality class. According to these data, it was concluded that plantago could be ensilaged without using additives.

Keywords: *Plantago, silage, fermantation, quality, molasses.*

INTRODUCTION

Plantago (Plantago lanceolata L.) is a perennial member of Plantaginaceae family which can easily grow on various types of soil. Plantago, one of the indigenous species of grass and pasture fields in Turkey, is a plant which is utilized as a human food and in animal feed and has a medical property as well with its phytochemical structure (Kara, 2016). Leaves of plantago plant which can be widely found in Turkey and most of European countries (Davis, 1975) are used as wound healers for centuries in various part of the world. Apart from these properties, it has a disease healing (against dermatologic and respiratory, digestive, cardiovascular system diseases) property (Berit-Samuelsen, 2000). This plant has expectorant, antimicrobial, antiviral, antitoxin and diuretic (Leung and Foster 1996) propertities and is used effectively in the treatment of tumors (Fracoise et al, 1998). Traditionally herbal tea of plantago leaves is used for diarrhea, dysentery and as an

antitussive. Leaves of the plant play an important role in healing the papilomas under the skin occuring as a result of blisters, wounds, swellings and insect stings, however; the seeds play an important role in reducing the cholesterol level in blood due to the mucilage inside (Foster and Duke, 1990; Sarıhan et al. 2005). These effects of these plant species on diseases derive from biologically active compounds such as polysaccharides, lipids, caffeic acid derivatives, flavonoids, iridoid glycosides and terpenoids. Also alkoloids and some organic acids were identified in these plant species (Berit Samuelsen, 2000; Okatan et al., 2015). Plantago is good at adaptation to drought and different types of soil. For that reason, the related plant has a significant potential for meeting the roughage need in livestock in the world in which the drought increases day by day and climate conditions begin to change rapidly (Kara 2016).

It was stated that plantago would be useful in pasture fields for animal nutrition since it has high mineral content and proper nutritional facts (Sanderson et al., 2003; Harrington et al., 2006). In a conducted study nutritional facts of plantago was compared with perennial grass and white clover plants in terms of macro and micro nutrients. In the study, it was determined that plantago plant was richer than perennial grass and white clover in terms of phosphorus, calcium, magnesium, sulfur, iron, manganese, copper, potassium, cobalt and zinc (Harrington et al. 2006). Plantago prevents the pasture tetania which occurs in grass and pastures and causes a significant yield loss due to high macro and micro nutrients (Anonymous, 2007). A drought-resistant and perennial plantago plant has 9-23 % of protein content (Gençkan, 1983; Tan and Yolcu, 2001). For that reason, this plant can be planted alone as a feed plant and mixed with grass and white clover as well. As a feed plant plantago can also be added to grass-pasture hybrids at 10-25 % levels.

Growth rate is very high in spring, summer and autumn seasons. It can easily maintain to grow in humid, hot and cool seasons. 6 tons of green grass can be harvested per decare. It can be used as grazing, silage, daily harvest and hay. With its high digestive ability plantago is rotationally grazed for 25 days since it can grow easily in hot and cool seasons. Plantago, a delicious feed plant, is gladly consumed by animals and provides high fattening and milk increase in animals (Anonymous, 2017). It was also found that plantago has a methane gas release reducing effect in ruminants (Kara, 2016). It is known that 65-70 % of total a livestock business consists of feed costs.

Alternative feed sources to be used in animal nutrition will result in a reduction of these costs, therefore higher yield will be obtained at lower costs. For that reason, it is important to clearly determine the feeding properties of plantago which would be important in ruminant feeding and the possibility to use as silages. Through this study ensiling possibilities of plantago plant were researched. In this context, nutrient contents, sensual analyses and fermentational properties of plantago plant were determined.

MATERIAL AND METHODS

Silage material

In the study silage parent material consisted of naturally grown plantago plants in Usak City Center. Silage was applied to 1lt of anarobe plastic jars as 3 parallels. Experiment groups were established by adding 3% of molasses as control and fermentation enhancer. Ensiling period lasted for 90 days at ambient temperature.

Chemical Analyses

The silage samples taken to represent the mass on the opening day of the silages and before the silage, study materials were dried in circulation oven for 48 hours at 65 ºC and the dry matter (DM) values were determined (AOAC, 1999). Samples were grained at 1 mm diameter of sieve after dried in circulation oven and by burning in ash furnace at 550 ºC for 4-6 hours as mentioned in AOAC crude ash (CA) contents were identified. By Kjeldahl method crude protein contents were identified (AOAC, 1999). ADF and NDF analyses were made by using Fiber Analyzer (Ankom Technology Corp. Fairport, NY, USA) device as Van Soest et al. (1991) reported (Ankom, 1998).

Analyses Used In Identifying Fermentation Properties

On the opening day of the silages in order to determine the pH values of the samples, pH of the liquid obtained by adding 100 ml of distilled water to 25 g of silage sample and then mixing with a shaker for 5 minutes was measured with digital pH meter (Polan et al., 1998). However, just after opening the silages, 40 g of silage sample was taken and 360 ml of distilled water was added in and shaken for 5 minutes. After the shaking procedure, the mixture was filtered through Whatman no:1 paper and NH3-N identification was carried out by Kjeldahl distilation method by taking 100 ml of the obtained filtrate. In addition, 2 ml of liquid was taken from the same filtrate and it was kept in a deep freezer at -18°C until the analysis day to identify volatile fatty acids (VFA) and lactic acid contents. Volatile fatty acid (asetic acid, propionic acid and butyric acid) and lactic acid analyses of the samples extracted from the freezer at the analysis day were carried out in HPLC device. (Properties of Device: Column: C18, 5 µm, 4.6 x 250-mm; Mobile Phase: Isocratic; 25-mM K-phosphate buffer; pH 2.4; Flow Rate: 1.5 mL/min.; Column Temperature: 30 ºC; UV Sensor: Wavelength: 210 nm; Injection Volume: 20 µL).

Sensual Analyses

On the opening day of the silages, the physical properties (odour, structure and colour) and quality points of silages were identified by 4 experienced panelists by using the silage assessment schedule of German Agriculture Organization (DLG, 1987).

Statistical Analyses

The results were analyzed in SPSS 16.01 package programme according to ONE-WAY ANOVA procedure and Duncan Multiple Comparison Test was applied for the differences of groups (SPSS, 2007).

RESULTS AND DISCUSSION

The results obtained after silaging the plantago, the parent material in the study, with no additives and 3% of molasses additives are presented in Table 1.

Table 1. Chemical compositions of plantago silages

	Control	**3 % Molasses**	$\overline{X}$	**P**
DM, %	27.78±0.13[b]	28.82±0.69[a]	28.30±0.69	0.02
OM, % DM	45.52±1.19	45.80±3.06	45.66±2.16	0.87
CA, % DM	15.14±0.32	15.61±0.59	15.37±0.51	0.21
CP, % DM	7.74±0.40	7.74±0.38	7.74±0.34	0.99

NDF, % DM	38.18±0.78	38.77±0.34	38.58±0.53	0.23
ADF, % DM	28.59±0.17	28.60±0.68	28.60±0.53	0.99

[a,b] : The differences between the averages in the same row are significant (P < 0.05). DM: Dry matter; OM: Organic matter; CA: Crude ash; NDF: Nötr deterjant fiber; ADF: Acid deterjant fiber; CP: Crude protein

Dry matter contents of plantago silages significantly increased with 3% of molasses additives (P<0.05). There are studies in which the quality of the silages are determined by adding molasses with high dry matter content to various fresh materials. These findings are similar with the ones that Bingöl et al. (2010) reported that 5 % of molasses additives to sunchoke silages increased the dry matter contents of silages and Bureenok et al. (2012) and Yunus et al. (2000) reported that 5 % of molasses additives to napier grass silages increased dry matter content of silages. No significant different was found in terms of chemical contents apart from dry matter contents of plantago silages (P>0.05). The findings indicating that NDF contents did not change with molasses additive to plantago silages were found to be compatible with the findings that Desta et al.(2016) reported that NDF contents did not change with 4 % of molasses additive to napier grass silages, Bureenok et al. (2012) reported that NDF contents did not change with 5% of molasses additive to napier grass silages and Duru (2012) reported that NDF contents did not change with 3 % of molasses additive to olive pulp silages. While they are not compatible with the findings reporting that ADF value decreased with Baytok et al.'s (2005) 5 % of molasses additive to corn silages, Arbabi and Ghoorchi's (2008) 5 % of molasses additive to foxtail milter silages and Desta et al.'s (2016) 4 % of molasses additive to rapier grass silages, they are compatible with findings reporting that ADF value did not change with Arbabi and Ghoorchi's (2008) 2.5 % of molasses additive to foxtail milter silages and Bureenok et al.'s (2012) 5 % of molasses additive to napier grass silages. The differences between the studies may derive from the different parent materials used in ensiling and different molasses level used during ensiling. Similarly, the findings indicating that crude protein content did not change with molasses additive to silages are similar with the findings reporting that crude protein content of the silages did not change with Bureenok et al. (2012); Bingöl et al. (2010); Li et al.'s (2014) 2 % of molasses additive to king grass silages and molasses additive to total mixed ration silages.

The values about fermentation characteristics of plantago silages are presented in Table 2.

Table 2. Fermentation characteristics of plantago silages

	Control	**3 % Molasses**	$\overline{X}$	**P**
pH	3.95±0.06	3.74±0.17	3.81±0.17	0.19
LA, %	0.99±0.81	1.36±0.11	1.18±0.52	0.59
AA, %	0.68±0.12	0.59±0.01	0.64±0.09	0.41
PA, %	0.21±0.30	0.14±0.20	0.18±0.21	0.81
BA, %	ND	ND		
NH_3-N	ND	ND		

LA: Lactic acid; AA: Acetic acid; PA: Propyonic acid; BA: Butyric acid; NH_3-N: Ammonia nitrogen
ND: Not determined.

No significant difference was found between the groups of plantago silages obtained through 0% (control) and 3 % of molasses additives in terms of fermentational properties (P>0.05). Although pH and lactic acid content developed with 3 % of molasses additives and

got better results, this difference remained at quantitative level (P>0.05). pH values did not change with molasses additives to the silages and this result is compatible with Baytok et al. (2005), Yuan et al.'s (2015) findings and Moselhy et al.'s (2015) findings with 5 % of molasses additives to hedychium gardneriaum silages. However, they are not compatible with Bureenok et al. (2012); Li et al. (2014) ve Bingöl et al.'s (2010) findings which reported that pH level decreased with molasses additives to silages. The finding indicating that lactic acid and asetic acid contents of plantago silages did not change significantly is not similar with Baytok et al. (2005); Bureenok et al. (2012) and Bingöl et al.'s (2010) findings which reported that lactic acid and asetic acid contents changed significantly. Ammonia nitrogen and butyric acid contents were not found in silages of the study. In addition, Bingöl et al. (2010), Bureenok et al. (2012) ve Yuan et al. (2015) reported that molasses additives during the ensiling did not change the butyric acid content of the silages, but decreased NH3-N content. This difference may derive from the different levels of the silaged materials and the added molasses.

The most important criteria in identifying the quality of the silages are the amount and composition of pH, ammonia nitrogen and organic asids during the fermentation. In early stage of the fermentation the decrease rate in ambient pH is highly important in order to get a quality silage (Ergün et al., 2004). Ammonia concentration in silages is a significant criterion which indicates the dissolution level of the proteins by butyric acid bacteria during the fermentation. Ammonia nitrogen is reported to be lower than 80g/kg total N in a quality silage (Petterson, 1988). Also McDonald et al. (1991) reported that deamination occured in aminoacids due to high level of acedic acid content in silages and as a result, ammonia level increased. When it is considered in terms of fermentational properties, it can be said that a good quality of silages are obtained from plantago. In fact, we can see that plantago silages contain sufficient lactic acid. Because water-soluble carbonhydrates blocked the ammonia formation by preventing proteolysis for the production of lactic acid and as a result pH value decreased and a suitable fermentation atmosphere was provided. In this concept, we can say that plantago can be silaged without additives in terms of chemical contents. The values about sensual analyses of plantago silages are presented in Table 3.

Table 3. Sensory analyses of plantago silages

	Control	3 % Molasses	$\overline{X}$	P
Smell	12.00	13.00	12.50	0.01*
Color	1.60	1.90	1.75	0.14
Structure	2.70	3.10	2.90	0.11
	16.40	18.00	17.20	0.01*

* The differences between the averages in the same row are significant (P < 0.05)

Sensual analyses (smell, colouri structure) of plantago was conducted by experienced 6 panelists. The differences concerning the total parameters for smell and appearance of silages with molasses additives to plantago were found statistically significant (P<0.01). However, the differences in terms of colour and structure were not found significant (P>0.05). Although the development was observed in sensual analysis results of silages with molasses additives, quality class of the control group was also "very good" as it was in the additive group. The leaves and stems of the silage forming plants should not have deterioration, stickiness and slimy appearance. Arslan Duru and Aksu Elmalı (2016) who

added molasses to clover silages reported that there was no significant difference in terms of smell, but there was a significant diffenrence in terms of colour and structure. Again in another study it was reported that there was no significant difference in terms of appearance with 3 % of molasses additives to feed turnip silages (Çetin, 2017). The differences between these findings may derive from the different ensiling materials.

Physical analyses, a cheap and easy method to identify the feed quality, is an evaluation via sense organs. Various colour tones from light green to black can be observed in silages depending on the parent material of silaged feed. The tones from dark green to black means the protein and sellulose dissolution in silages. In addition silages should not contain soil pollution. The fact that no excessive increase is observed in crude ash, NDF and ADF values in plantago silages and they have the desired values, there is no ammonia nitrogen and butyric acid contents support that there is no negative situation in plantago silages in terms of odour, colour and structure.

CONCLUSIONS

Within the scope of this study it is aimed to research the ensiling possibilities of plantago which is considered as a good alternative roughage. According to the obtained results, it is found out that plantago can be ensiling without any additives because all parameters of plantago silages have the desired levels in terms of crude nutrients contents and fermentation properties, even there is no butyric acid and ammonia nitrogen, they are in "very good" class in terms of sensual properties.

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