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Effects of chemical composition and some quality characteristics of laurel leaves supplementation to sugar beet leaves silages

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Abstract: *This study was carried out to determine the effect of laurel (Laurel nobilis L.) leaves at different levels on chemical composition, some fermentation characteristics, dry matter intake, dry matter digestibility and relative feed value of sugar beet leaves silages. Laurel leaves were added to sugar beet leaves at the levels of 0 % (control), 1, 2 and 4 with four replicates. After 75 days, jars were opened. By adding laurel leaves to sugar beet leaves silages, dry matter (P<0.001), NDF (P<0.05) and ADF (P<0.05) contents increased, and the crude ash (P<0.001) and crude protein (P<0.05) contents decreased. The differences in pH, propionic acid, butyric acid contents were not found significant (P>0.05). Ammonia nitrogen and acetic acid content could not be determined in experiment silages. Dry matter intake, dry matter digestibility and relative feed value decreased with laurel leaves supplement (P> 0.05). It has been determined that the laurel leaves have a positive effect on sugar beet leaves silage, especially its chemical composition.*
Key Word*:Sugar beet leaves; laurel leaves; fermentation; silage; volatile fatty acids.*

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I. Introduction

Sugar beet is planted for sugar production and significant amounts of sugar beet leaves are obtained as a by-product. While some of the leaves obtained during the harvest of sugar beet are considered as a source of fresh roughage, a significant part of it is left in the field and mixed with the soil as an organic fertilizer (Pimlott, 1991). It is reported that 80-85% of sugar beets root yield has been obtained from sugar beet leaves, however, approximately 80% of these beet leaves remain in the field and only 2 % are ensiled (Przybyl, 1994). However, in cases of ensiling, it is very difficult to create good fermentation conditions due to low dry matter and water-soluble carbohydrate content in sugar beet leaves silages. For this reason, different additives have been used in recent years to improve silage quality and maintain silage for a longer period of time.

In recent years, antioxidant and antimicrobial plants have been used as additives in silage studies. Laurel (*Laurus nobilis*) is a member of the *Lauraceae* family and has a high culinary value. Laurel leaf has been used in western countries in traditional medicine for the treatment of rheumatic disease treatment and indigestion (Fang et al., 2004). In addition to its antioxidant properties, laurel is known as an antiseptic, antibacterial, appetite-enhancing and digestive aid source (Baratta et al., 1998; Kamel, 2000). Considering these features of laurel leaf, it is thought that it can be an important alternative additive in silage.

This study was carried out to determine the effect of laurel leaf on chemical composition, some fermentation properties, dry matter intake, dry matter digestibility and relative feed value of sugar beet leaves silages.

II. Material And Methods

The sugar beet leaves used in the experiment were collected from the land of sugar beet cultivation in Uşak Province in Turkey. Laurel (*Laurel nobilis* L.) leaf as using an additive was obtained from a local market. It was grounded to a 1 mm sieve diameter. Chopped sugar beet leaves (1.5-2 cm length) with grounded laurel leaf powder were ensiled in 1-liter anaerobic jars under laboratory conditions with 4 replicates. After ensiling, jars were stored at the temperature +20 to +25 °C. Ensiling was carried out as follows: (1) 0 % (control-no additives), (2) 1.0 % laurel leaf, (3) 2.0 % laurel leaf and (4) 4.0 % laurel leaf. After 75 days, jars were opened and analysed.

Dry matter, crude ash and crude protein contents of silages and laurel leaves were determined as indicated in AOAC (1999). Dry matter, crude ash and crude protein contents of laurel leaves are given in Table 1.

Table no 1. Dry matter, crude ash and crude protein contents of laurel leaves

	Dry Matter, %	Crude Ash, % DM	Crude Protein, % DM
Laurel Leaf	93.86	1.13	8.56

The ADF and NDF analyses of the sugar beet leaves silages were performed as reported by Van Soest (1982). The pH of the silages with the digital pH meter was assayed according to the method reported by Polan et al. (1998). However, immediately after opening of the silages, 40 g of the silage sample was taken and shaken for at least 5 minutes by addition of 360 ml of distilled water. Then, the mixture was filtered and NH_3-N was determined by Kjeldahl distillation with 100 ml of this filtrate. (Broderick and Kang, 1980). Volatile fatty acids (acetic acid, propionic acid and butyric acid) and lactic acid were analysed according to method reported by Suzuki and Lund (1980) using high-performance liquid chromatography (HPLC Conditions: 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 Detector: Wavelength: 210 nm; Injection Volume: 20 µL.

The relative feed value, dry matter intake and dry matter digestibility of sugar beet leaves were calculated using the equations developed by Van Dyke and Anderson (2000).

The data of the study were analysed according to One-way Anova procedure and Duncan Multiple Comparison Test was applied for the differences of the groups (SPSS, 2007).

III. Resultand Discussion

The effects of laurel leaves on chemical composition of sugar beet leaves silages are presented in Table 2.

Table no 2 The effects of laurel leaves on chemical composition of sugar beet leaves silages

Parameters	Laurel Leaves Levels, %				P
	Control	1.0	2.0	4.0	
DM, %	12.74±0.82^{c}	17.64±0.64^{b}	17.19±1.00^{b}	22.49±2.70^{a}	0.0001
CA, % DM	13.81±0.58^{a}	13.08±0.35^{b}	11.68±0.28^{c}	10.60±0.28^{d}	0.0001
CP, % DM	21.40±1.24^{a}	20.27±0.84^{ab}	18.66±0.42^{b}	19.27±1.67^{b}	0.02
NDF, % DM	24.67±0.69^{b}	24.27±1.37^{b}	31.21±1.86^{a}	32.90±4.83^{a}	0.03
ADF, % DM	16.02±0.70^{b}	15.70±0.77^{b}	20.84±1.63^{a}	19.77±0.89^{a}	0.003

DM: Dry Matter; CA: Crude Ash; NDF: Neutral Detergent Fiber; ADF: Acid Detergent Fiber. CP: Crude Protein;
$^{a-d:}$: The differences between the averages in the same line are significant (P < 0.05).
$^{a-b:}$: The differences between the averages in the same line are significant (P < 0.01).

Dry matter contents of experiment silages increased with laurel treatment (P<0.001). The highest dry matter content was observed at 4% laurel (P <0.001). The control group was found to have the lowest dry matter content when compared to other groups (P<0.001). It was observed that laurel leaves containing high levels of dry matter (Table 1) increased the dry matter content in sugar beet leaves silages. One of the main purposes of ensiling is to minimize dry matter losses in the material to be ensiled as much as possible. No loss of dry matter content in experiment silage indicates a good fermentation. Observations similar to this study were reported by Can et al (2001).

Crude ash content of silages was significantly reduced in each treatment group with laurel leaf added (P<0.001). Crude ash content of the control group was found to be statistically higher than the other groups. (P<0.001). The crude ash in silage is a factor in determining the silage pollution and fermentation quality. However, it can be said that the crude ash content of the experiment silages also decreased due to the low crude ash content of the laurel leaves. Uludağ (2011) stated that the sugar beet leaves have a crude ash content of 19.70 %. Laurel leaf supplementation resulted in a decrease in crude protein content of silages (P<0.05). In particular, the crude protein content of 2 % and 4 % laurel leaf is lower than the control group. It is understood that the low protein content of laurel leaves reduces the crude protein content of the sugar beet leaves silages. Similarly, Arslan Duru and Çolak (2019) reported that the crude protein content of silages decreased by adding goji berry leaves to sugar beet leaves.NDF (P<0.05) and ADF (P<0.01) content of cell wall components of sugar beet leaves silages were statistically increased with the addition of 2 % and 4 % laurel. Due to the high NDF and ADF content of the laurel leaves, it was observed that the silages also increased the NDF and ADF. Özkan et al. (2017) reported that sugar beet leaves silages had 35.72 % and 16.18 % content of NDF and ADF, respectively.The effects of laurel leaves on some fermentation characteristics of sugar beet leaves silages are given in Table 3.

Table nov3 The effects of laurel leaves on fermentation characteristics of sugar beet leaves silages

Parameters	Laurel Leaves Levels, %				P
	Control	1.0	2.0	4.0	
pH	4.60±0.19	4.91±0.20	4.81±0.08	4.67±0.32	0.51
NH_3-N	ND	ND	ND	ND	
LA, %	1.38±0.26[b]	1.99±0.04[a]	1.61±0.15[ab]	1.19±0.01[b]	0.03
AA, %	ND	ND	ND	ND	
PA, %	0.16±0.04	0.14±0.17	0.17±0.24	0.14±0.03	0.98
BA, %	0.17±0.04	0.25±0.35	0.32±0.39	0.20±0.08	0.94

[a-b:] Differences between the means indicated by different letters on the same line are statistically significant (P<0.05). LA: Lactic acid; AA: Acetic acid; PA: Propionic acid; BA: Butyric acid, NH_3-N: Ammonia nitrogen; ND: Not Determined.

According to the findings, the pH of the sugar beet leaves silages was not affected by laurel leaf treatment (P>0.05). Whilst the lowest pH was observed in the control group; the highest pH was found in laurel leaf at 1.0 %. Ammonia nitrogen and acetic acid content in sugar beet leaf silages could not be determined. Lactic acid, one of the most important parameters in silages, was found to be significantly higher in 1.0% laurel leaf compared to 4.0% laurel leaf. (P<0.05). The effect of laurel leaf supplement on propionic acid and butyric acid content on sugar beet leaves silages was not significant. (P>0.05). Butyric acid content, which is an important quality criterion in silages, is in the lowest control group compare to other groups. pH, ammonia nitrogen and the amount and composition of organic acids formed during fermentation are extremely important and are the primary parameters in determining silage fermentation and silage quality. Also, ammonia concentration in silage is a criterion that shows the level of protein degradability by butyric acid bacteria during fermentation. It is reported that ammonia nitrogen should be lower than 80 g/kg total nitrogen in a quality silage (Petterson, 1988). The absence of ammonia nitrogen and the presence of a small amount of butyric acid in the experiment silages show that the ensiling has been done successfully. It can be said that sugar beet leaves silages, which are poor in water soluble carbohydrates, are produced to prevent silage deterioration even if the lactic acid content is not high. In addition, the absence of ammonia nitrogen in the silage showed that the desired level of lactic acid occurred. Also, in some studies, similar to current study, it was concluded that the presence of lower lactic acid content can provide good quality silage (Baytok et al., .Alhan and Can (2017) reported that there was no butyric acid and 9.26 % ammonia nitrogen in sugar beet leaves silages. Gürbüz and Kaplan (2008) indicated that 0.11% of the lactic acid content in sugar beet leaf silages.The effects of laurel leaves on dry matter intake, dry matter digestibility and relative feed value of sugar beet leaves silages were shown in Table 4.

Table no 4. The effects of laurel leaves on dry matter intake, dry matter digestibility and relative feed value properties of sugar beet leaves silages

Parameters	Laurel Leaves Levels, %				P
	Control	1.0	2.0	4.0	
Dry matter digestibility, %	76.39[a]	76.68[a]	72.66[b]	74.64[ab]	0.04
Dry matter intake, %	4.87[a]	4.95[a]	3.86[b]	3.71[b]	0.01
Relative feed value	288.20[a]	294.33[a]	217.00[b]	214.96[b]	0.01

[a-b:] Differences between the means indicated by different letters on the same line are statistically significant (P<0.05).

The dry matter digestibility varied between 72.66% and 76.68% and this value decreased with the treatment of laurel leaves (P <0.05). The lowest dry matter digestibility value was detected especially in laurel leaves treatment at the level of 2 %. Dry matter digestibility is calculated based on the ADF content of roughages. As ADF content increased with the supplementation of laurel leaves in silage, dry matter digestibility decreased. Dry matter intake and relative feed value decreased statistically significantly with the addition of laurel leaves at levels 2 and 4 % (P<0.01). Similarly, dry matter intake is a parameter obtained from the NDF content of roughages. Dry matter intake decreased due to the increase in NDF content with laurel leaves treatment in silage. Canbolat et al. (2010) found that dry matter intake, dry matter digestibility and relative feed value increased as NDF and ADF content decreased in silages.

IV. Conclusion

Roughages are very important in feeding ruminants. The yields of ruminants mainly depend on the quality of the roughage. Effective use of quality, easy-to-supply and cheap feed sources is of great importance, especially in feeding ruminants. For this reason, it is necessary to use the by-products effectively.At the end of the study, it can be said that silage has a positive effect on the chemical composition by adding different levels of laurel leaf to sugar beet leaves silages. However, it has been concluded that higher results can be obtained by doing animal digestion experiments.

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