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SEASONAL CHANGES IN THE MORPHOLOGICAL TRAITMENTS AND FORAGE QUALITY OF KERMES OAK (*Quercus coccifera* L.)

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Abstract

This study was conducted in order to determine the seasonal changes in the forage quality of Kermes Oak under Mediterranean region of Turkey in 2013-2014 years. Leaf samples were taken as 150 number in the middle of each month from the same geographical sides and altitude. The leaf width, leaf length, crude protein (CP) ratio, neutral detergent fiber (NDF), acid detergent fiber (ADF), total digestible nutrient (TDN) and relative feed value (RFV) were determined in this research. According to results, the highest leaf width and leaf length were determined on samples taken in July and August. The highest ADF and NDF values were obtained from samples taken in October and November. The samples taken in February, March, April and May had the highest TDN and RFV values.

Key words: crude protein, goat, kermes oak, relative feed value, shrubs.

INTRODUCTION

The areas where the Mediterranean climate type is seen in the world are around 100 million hectares. 32 million hectares of these areas are located in the Mediterranean coast. In Turkey has approximately 7 million hectares of vegetation formed under the influence of Mediterranean climate (Baytekin et al., 2005).

The Mediterranean climate is described as hot and dry in summers and moist and cool in winters. The hot and dry summer months severely limit the development of especially herbaceous species. However, shrubs with deep roots maintain the green appearance of the vegetation in this season. With the cooling of the air in the autumn and the start of the precipitation, especially the cool climate, the grassy species are developing again. In the winter months, the herbaceous species continue to grow as water and temperature become suitable for plant development. Depending on the climatic factors, this evolution of plants also affects the way animals benefit from these areas. According to these differences, animals prefer abundant or scarce, green or dry, grassy or woody species (Gökkuş et al., 2009).

Maquis shrublands are considered as natural feed areas especially for the goats at all times of the year. There is a close relationship between the maquis areas in the Mediterranean region and the goat flocks. As is the case in the world, goat breeding is most common on these areas also in our country and it is the main feed sources of the goats (Papachristou et al., 1999, 2003; Rogosic, 2000). It has been noted that over 60% of goats' feed were formed by shrubs in the Mediterranean maquis shrublands (Perevolotsky et al., 1998). The shrubs of the Kermes are seen as precious feed sources for domestic and wild animals, for the people in the area to burn and for preventing soil erosion (Vrahnakıs et al., 2005). Similarly, in Spain it is emphasized that the marble forest prevents erosion, contributes to the formation of the soil, recovers the area after the fires, and is important as a food and shelter for domestic and wild animals (Canellas and San Miguel, 2003).

Kermes oak thickets constitute more than 2.4 million hectares area in Turkey. This area constitutes 10% of the general forest area of the country. The kermes oak forms a grassland area for 9 million hair goats. (TÜİK, 2013). Kermes oak is the natural plant of the Mediterranean region. Where the Mediterranean climate is seen, the kermes oak is an important goat food. The Kermes oak provides the proportion of crude protein needed for goat feeding, except during the winter season (Alatürk et al. 2014).

This study was conducted in order to determine the seasonal changes in the forage quality of Kermes Oak under Mediterranean region of Turkey in 2013-2014 years.

MATERIALS AND METHODS

The research was conducted at Isparta (37°45′N, 30° 33′E, altitude 1035 m) located in the Mediterranean region of Turkey, between 2013 and 2014 years.

The climatic data are given in Table 1 for the experimental area.

Table 1. The climatic data

Month	Temprature (^{0}C)			Total rainfall (mm)			Average relative humidity (%)		
	LT*	2013	2014	LT	2013	2014	LT	2013	2014
January	1.9	2.8	3.7	72.4	58.6	61.3	73.1	72.5	76.7
February	2.8	4.9	5.2	65.5	101.9	23.4	70.4	70.6	60.8
March	6.1	7.3	7.3	53.8	25.1	78.6	65.4	59.7	63.3
April	10.7	12.1	11.7	56.2	59.9	44.8	61.3	56.5	59.5
May	15.6	18.0	15.1	50.4	66.5	107.0	57.4	50.4	60.3
June	20.2	21.0	20.0	29.6	34.4	42.8	51.2	47.4	49.8
July	23.6	23.5	24.5	14.9	88.2	0.8	45.4	41.5	43.5
August	23.2	24.1	24.9	10.5	15.4	10.2	46.4	39.1	44.2
September	18.6	18.9	18.4	15.4	3.0	99.2	51.9	43.3	58.6
October	12.9	10.7	12.9	37.6	104.0	57.1	62.0	54.0	64.7
November	7.4	8.7	6.8	46.5	67.6	37.0	68.5	65.5	69.2
December	3.4	1.0	6.0	84.5	29.4	108.6	74.7	64.2	75.2
Av./Tot.	**12.2**	**12.75**	**13.04**	**537.3**	**654**	**670.8**	**60.64**	**55.39**	**60.48**

(*) Long term average

The experiments were evaluated in a randomized complete block design with three replications. While sampling in the shrubs was done by imitating animal grazing habits from parts of animals that were accessible but not grazed by animals. For this purpose, 150 leaf samples were cut with a bond cutter from the same geographical side and the same height every month and put on the pouch paper.

Chemical analyzes were made in the laboratory of Field Crops Department at Süleyman Demirel University. At first morphological observations such as leaf width and length were measured with 0.01 mm sensitive caliper. The samples were dried at room temperature then dried in an oven at 65°C till they reached constant weight. After cooling and weighing, the samples were ground for crude protein, ADF and NDF content analyses. Nitrogen content was calculated by the Kjeldahl method; The ANKOM Fiber Analyzer was used for NDF and ADF analysis. ANKOM F57 filter bags were used for ADF and NDF analysis in this study. Total digestible nutrients (TDN) and relative feed value (RFV) were estimated according to the following equations adapted from Horrocks and Vallentine (1999):

TDN = (-1.291 x ADF) + 101.35,

RFV = %DDM x %DMI x 0.775,

The data were analyzed together using the Proc GLM (SAS 1998). Means were separated by LSD at the 5 % level of significance.

RESULTS AND DISCUSSIONS

The results of variance analysis are presented in Table 2. Changes in leaf width, leaf length, CP, NDF, ADF, TDN and RFV were found significant between the months. The means are indicated in the table 3 andresults of the Duncan test are indicated in Latin letters near the means.

Table 2. The results of variance analysis

	Df	LW	LL	CP	NDF	ADF	TDN	RFV
Block	2	0.083	0.0277	0.001	4.917	2.341	4.126*	41.600*
Vegetation Season	11	1.58**	3.444**	0.063**	86.743**	76.974**	128.106**	842.592**
Error	22	0.053	0.0277	0.002	1.045	0.534	0.869	10.518

df: degrees of freedom, LW: Leaf Width, LL: Leaf Length, *P<0.05 and **P<0.01.

Maximum leaf widthwas recorded (18.00 mm) in July and August while the minimum leaf widthwas recorded (16.00 mm) in November, December and January.leaf lengthwas at the maximum (27.00 mm) in July and August, at the lowest level (24.00 mm) in December, January and February.

Crude protein ratio of the plant showed a peak in April (11.63) and the crude protein content decreased as the growth progressed.As the development progresses, decreases in protein ratio and increases in cell wall materials are observed (Haddi et al., 2003).Our results are similar with the results of Parlak et al. (2011) and Gökkuş et al. (2009).

Neutral detergent fiber (NDF) and acid detergent fiber (ADF)exhibited a significant increase from July to November later started to decrease and kept its lowest level in February, March, April and May.Cell wall materials (NDF, ADF and ADL) varied according to plant species and growth periods. At the beginning of growth, it is known that the vast majority of cell protoplasm contents of plants are composed of water and cell wall materials are at the lowest level. Cell wall materials are more associated with the presence of mature cells than younger cells (Lyons et al., 1999).It is also known that there is an increase in cell wall materials and a decrease in leaf/stem ratio due to maturation in plants (Frost et al., 2008). These results are in agreement with those reported by Alatürk et al. (2014) and Kökten et al. (2012), Tolunay et al. (2009) and Bouazza et al. (2012).

The highest total digestible nutrient (TDN) and relative feed value (RFV) were obtained from samples taken in February, March, April and May. The TDN refers to the nutrient that are available for livestock and are related to the ADF concentration of forage. The RFV is an index that is used to predict the intake and energy value of the forages. Forages with an RFV value over 151, between 150-125, 124-103, 102-87, 86-75 and less than 75 are considered as prime, premium, good, fair, poor and reject, respectively (Lithourgidis et al., 2006).

Table 3. The LW, LL values and CP, NDF, ADF, TDN, RFVratios of Kermes oak at different moths

Month	LW	LL	CP	NDF	ADF	TDN	RFV
February	16.11 d	24.00 e	10.13 c	49.33 f	34.03 f	57.40 a	118.00 a
March	16.33 cd	25.00 d	10.87 b	48.13 f	33.20 f	58.47 a	121.83 a
April	17.00 b	26.00 b	11.63 a	48.20 f	33.26 f	58.41 a	121.55 a
May	17.00 b	26.00 b	11.89 ab	48.03 f	33.13 f	58.56 a	122.14 a
June	17.00 b	25.66 c	10.13 c	55.03 d	38.00 e	52.32 b	100.26 c
July	18.00 a	27.00 a	9.93 cd	57.63 c	42.66 c	46.29 d	89.85 d
August	18.00 a	27.00 a	9.44 de	58.03 c	42.93 c	45.91 d	88.86 d
September	17.00 b	26.00 b	9.06 e	60.06 b	44.46 b	43.96 e	84.81 de
October	16.66 bc	25.00 d	9.00 e	61.50 ab	45.50 ab	42.59 ef	80.82 e
November	16.00 d	25.00 d	8.88 e	62.16 a	46.00 a	41.96 f	79.44 e
December	16.00 d	24.00 e	9.19 e	55.13 d	40.83 d	48.68 c	96.35 c
January*	16.00 d	24.00 e	9.38 de	51.77 e	37.23 e	53.26 b	107.68 b

(*) 2014

CONCLUSIONS

The season is an important factor affecting the nutritional value of the kermes oak. The nutritive value of the leaves of the kermes oak changes as it matures.

Considering that the protein level of ruminants consumed by ruminants should be at least 10,60% (NRC, 2001), the Kermes oak produced sufficient crude protein feed for animals on February, March, April, May and June.The crude protein content of the kermes oak was reduced due to ripening, whereas the cell wall compounds (NDF, ADF) were increased.

It is not desirable for animals to consume more than 45.8% of NDF and 25% of ADF content per day (NRC, 2001). In general, the Kermes oak has included NDF and ADF over the border values throughout the year.

As a result, it is known that woody species are best appreciated by the goats, and when grazing is done with the goats, the feeding value of the kermes oak is generally sufficient, but supplementary feed should be given to meet the protein deficit in the winter. In addition,

Kermes is a green food source for grazing animals because of its evergreen characteristic. Therefore, if maquis, pastures in and over the forest, forest areas deteriorated in structure that covered with kermes oak are included in the grazing systems, livestock farming may be more profitable with the extension of the grazing period and the reduction of roughage costs.

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