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Asian Journal of Animal and Veterinary Advances

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Asian Journal of Animal and Veterinary Advances 4 (2): 99-103, 2009
ISSN 1683-9919


# The Effects of Different Vegetation Periods on Chemical Composition of Kermes Oak (*Quercus coccifera* L.)

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**Abstract:** This study investigates the effect of different vegetation periods on the chemical composition of kermes oak. Five different vegetation periods from May through September 2008 were taken into consideration for this purpose. Throughout these periods, values for dry matter, crude protein, crude lipid, crude fiber, nitrogen-free extracts, crude ash and metabolizable energy were measured. The chemical composition of kermes oak underwent statistically significant changes in counection with the vegetation period ($p<0.05$). During the May, June, July, August and September periods, the natural dry matter content of kermes oak was found to be 43.26, 53.83, 56.85, 57.35 and 57.95%, respectively. During the same periods, values for crude protein with respect to dry matter were 1.27, 1.20, 1.29, 1.47 and 1.59%, respectively, values for crude lipid were 4.37, 3.95, 3.47, 2.69 and 3.73%, respectively, values for crude fiber were 20.88, 30.91, 35.53, 37.21 and 37.08%, respectively, values for nitrogen free extracts were 69.48, 59.98, 55.45, 55.57 and 54.35%, respectively, values for crude ash were 3.99, 3.95, 4.22, 3.05 and 3.25% , respectively and values for metabolizable energy were 3191.65, 3149.65, 3129.35, 3119.92 and 3124.15 kcal $kg^{-1}$, respectively. In conclusion, it was determined that the chemical composition of kermes oak underwent changes in counection with the vegetation period and that, in particular, as the vegetation period advanced, the crude fiber content increased and nitrogen-free extracts decreased.

**Key words:** Kermes oak, chemical composition, vegetation period, pure hair goat

## INTRODUCTION

Raising pure hair goats plays an important economic and social role in Turkey. In particular, pure hair goats provide the most important source of income for farmers living in villages that are within or adjacent to forests. Although pure hair goat raising in Turkey has shown a drop over the years, it maintains its significance in so far as animal products such as milk, meat and leather are concerned. Goats make up 2.80, 3.50 and 3.91% of milk, meat and leather production, respectively (Kaymakcı *et al*., 2005). The goat species that are most commouly raised in Turkey are the pure hair goat and the angora goat. Of these two species, the pure hair goat (*Capra hircus* L.) is the most commonly raised species at 96% (Ozder, 1997).

There are approximately six million pure hair goats in Turkey (TUIK, 2008). However, a significant drop in the number of pure hair goats, has been recorded as a result of various policies put in place in recent years. Nevertheless, despite this drop, the raising of pure hair goats continues to maintain its place and importance in the country because pure hair goats are animals that garner the highest value from shrub areas that cannot be used for any purpose other than for goat grazing. The typical vegetation of the Western Mediterranean Region, in particular, where pure hair goat raising is most widespread, consists of shrub lands (Kiliçkiran, 1991; Rogosic *et al*., 2006). There are similarities between areas where pure hair goats are raised and areas where certain tree-like plant varieties are

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dispersed. One of these tree-like varieties is the kermes oak (*Quercus coccifera* L.), which can be found throughout 2.4 million hectares of land in Turkey's Aegean and Mediterranean Regions either by itself or mixed with other trees or shrub varieties. Kermes oak is a plant variety that pure hair goats consume throughout the year (Kamalak *et al*., 2004; Boubaker *et al*., 2004).

The nutritional value of kermes oak which provides the most significant feeding source for pure hair goats has not been sufficiently studied in Turkey. In particular, no studies have been conducted regarding the changes in nutrient composition in counection with vegetation periods.

This study was designed to determination the changes in the nutrient composition of kermes oak (*Quercus coccifera*) during different vegetation periods.

## MATERIALS AND METHODS

### Study Area

This study was conducted at Süleyman Demirel University, Research and Implementation Forest Areas, in Isparta Province, Western Mediterranean Region of Turkey. The study area is located between 37° 83'50"-37°83'31" north latitude and 30°51'72"-30°51'94" east longitude and has an elevation of 1.250 m. Its slope is to the southwest.

According to data provided by Isparta Meteorology Station, the long-term average annnal raiufall is 600.4 mm and the average air temperature is 12.1°C. During the winter (December-March) and summer (June-September) seasons, the average air temperature ranges from 1.7 to 5.8°C and 19.7 to 23.1°C and the average rainfall ranges from 90.0 to 100.0 m and 9.6 to 36.6 m, respectively. The climate of the area is characterized as semi-arid and cold winters. The soil texture is clay to wet clay, derived from conglomerates of the mesozoic period and colluvials from river or torrent bank deposits (Atalay, 2006). A range of organic matter content between 2.60-3.20% and a pH (7.5) are both considered average.

The shrub variety that shows a native range within the study area is kermes oak. Up until seven years ago (prior to 2002), this area was used for grazing pure hair goats, but it was, subsequently, assigned by the university to be used for research and implementation and was closed to any type of grazing. The land coverage rate of kermes oak ranges from 70 to 90% and shrub height ranges from 50 to 150 cm.

### Experimental Methodology

An area of 3 ha was selected within the university research forest with the same growth environment and site characteristics (aspect, elevation, slope, soil, etc.). Within this area, kermes oak shrubs spread over an area of at least 6 $m^2$ were identified and 30 shrubs with this characteristic were selected at random. A sampling quadron of 1×1 m was created by using wooden slats. Representative, hand-plucked forage samples (Cook, 1964) similar to those consnmed by animals were collected. Samples from the study area were collected on May 15, June 15, July 15, August 15 and September 15, 2008.

In order to determine the chemical composition of kermes oak, 30 herbage samples obtained at each period were mixed and pooled then taken to the herbage analysis laboratory at Süleyman Demirel University, School of Agriculture, Department of Animal Husbandary. Dry matter was identified first within the samples. Samples were later dried in an air-forced oven at 65°C for 24 h to determined the primary moisture content. Then experimental samples were ground through a 1 mm screen. Dry matter content was determined by oven-drying at 105°C for 16 h. Crude ash was determined by incineration at 550°C in muffle furnace at for 12 h. The crude protein was determined by using the Kjeldahl method (AOAC, 1990). Crude lipid content was obtained through the Soxhlet extraction method using anhydrous diethyl ether. The crude fiber content was determined using 12.5% $H_2SO_4$ and 12.5% NaOH solutions (Naumaun and Bassler, 1997). Metabolizable energy was calculated using the following formula (TSE, 2008):

$$ME\ (kcal\ kg^{-1}) = 3260+[0.455\times CP\%]+[3.517\times CL\%] - [4.037\times CF\%]$$

Where:
ME = Metabolizable energy
CP = Crude protein
CL = Crude lipid
CF = Crude fiber

**Statistical Analysis**

All data sets were subjected to repeated measurements of ANOVA in order to test statistical significance across the five periods. Tukey test was applied in order to test statistical differences between means (Steel and Torrie, 1980). The statistical analysis were carried out using SPSS 16.0 software for Windows. All tests were performed at the level of significance of $p<0.05$. All determinations were made via., triplicate testing.

## RESULTS

The proximate analysis content of kermes oak including dry matter, organic matter, crude protein, crude lipid, crude fiber, nitrogen-free extracts, crude ash and metabolic energy in connection with different vegetation periods are presented in Table 1.

As indicated by the values in Table 1, the dry matter content of kermes oak undergoes statistically significant changes in connection with vegetation periods ($p<0.05$). As these changes are statistically evident from May to July ($p<0.05$), they are not significant in July and September ($p>0.05$).

The highest significant differences ($p<0.05$) values of kermes oak organic matter content was recorded for samples collected during August and September compared to May, June and July ($p>0.05$).

The crude protein content of kermes oak undergoes statistical changes in relation with the vegetation periods ($p<0.05$). While the crude protein content in May, June and July displays similar values, the crude protein content rises in August and September ($p<0.05$). In terms of crude lipid content, it is determined that kermes oak again undergoes statistical changes due to vegetation periods ($p<0.05$).

The crude fiber content of kermes oak also appears to have undergone statistically evident changes in relation with the vegetation periods ($p<0.05$). Particularly during May and June, the onset and change periods of vegetation display statistically significant changes both between themselves as well as other months (July, August and September) ($p<0.05$). In July, August and September, the crude fiber content does not display any statistical changes ($p>0.05$).

Also in terms of nitrogen free extract, it is observed that the kermes oak displays a significant difference from a statistical perspective in relation with the vegetation period ($p<0.05$). The months

Table 1: Effects of different vegetation periods on chemical composition of kermes oak (*Quercus coccifera*)

| | | Dry matter basis (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vegetation periods | Moisture basis, dry matter (%) | Organic matter | Crude protein | Crude lipid | Crude fiber | Nitrogen-free extract | Crude ash | ME (Kcal $kg^{-1}$) |
| May 15 2008 | 43.26$^{c,1}$ | 96.00$^{b}$ | 1.27$^{c}$ | 4.37$^{a}$ | 20.88$^{c}$ | 69.48$^{a}$ | 3.99$^{b}$ | 3191.65$^{a}$ |
| June 15 2008 | 53.83$^{b}$ | 96.04$^{b}$ | 1.20$^{c}$ | 3.95$^{a,b}$ | 30.91$^{b}$ | 59.98$^{b}$ | 3.95$^{b}$ | 3149.65$^{b}$ |
| July 15 2008 | 56.85$^{a}$ | 95.74$^{b}$ | 1.29$^{c}$ | 3.47$^{b}$ | 35.53$^{a}$ | 55.45$^{c}$ | 4.22$^{b}$ | 3129.35$^{c}$ |
| Aug.15 2008 | 57.35$^{a}$ | 96.94$^{a}$ | 1.47$^{b}$ | 2.69$^{c}$ | 37.21$^{a}$ | 55.57$^{c}$ | 3.05$^{a}$ | 3119.92$^{c,d}$ |
| Sept.15 2008 | 57.95$^{a}$ | 96.75$^{a}$ | 1.59$^{a}$ | 3.73$^{a,b}$ | 37.08$^{a}$ | 54.35$^{c}$ | 3.25$^{a}$ | 3124.15$^{d1}$ |

[1]Means in the same column followed by the same letters are not significantly different at the 0.05 level. ME: Metabolizable energy

of May and June have a statistically different content of nitrogen free extract both between themselves and compared with the other periods. In the period July-September, the nitrogen free extract does not have any statistical difference ($p>0.05$).

In the evaluation of the values obtained in terms of crude ash, it is observed that the vegetation period has a statistical effect ($p<0.05$). The period May-July, has a crude ash content statistically higher than the period August-September ($p<0.05$).

It is determined that also the metabolizable energy values change statistically in relation with the vegetation period ($p<0.05$). Generally, a decrease is observed in metabolizable energy in relation with the vegetation period.

## DISCUSSION

Kermes oak constitutes an important source of nutrition in the grazing of pure hair goats in Turkey. However, no sufficient data are not available regarding the period in which this nutrition source has the highest herbage yield and nutrient contents. Goat farmers graze the animals in scrublands in a haphazard manner without any plan. Since, goat farmers do not know the period that is most productive for goat grazing, they are unable to utilize these lands effectively. This study aims to determine the period that is most productive in terms of nutrient content for goat grazing. The presents results indicate, that the nutrient content composition of kermes oak undergoes statistically significant changes in relation with the vegetation periods ($p<0.05$).

Akyıldız (1986) and Ergül (2008) who provide information on the nutritional values of various field and pasture plants, indicate that as the vegetation period advances in time, the ratios of dry matter and crude fiber in all feed plants increase while the ratio of crude lipid first increases and subsequently decreases. The results obtained in this study support these findings. In their study regarding the nutritional value of certain kermes-type leaves growing in Turkey, Kamalak *et al*. (2004) determined that the leaves of kermes oak (*Quercus coccifera* L.) harvested in July contain organic matter of 93.08%, crude protein of 3.62%, crude fiber of 38.2%, crude lipid of 4.44% and crude ash of 6.91%. With the exception of crude protein, nutrient values obtained in this study during the same period display values similar to those obtained in Kamalak *et al*. (2004). According to all research findings, upon consideration particularly of the dry matter content of plants, it has been concluded that it is more suitable to graze goats in the Western Mediterranean Region of Turkey starting with the month of June.

## ACKNOWLEDGMENTS

The researchers extend their gratitude to the Turkish Scientific and Technical Research Council of Turkey (TUBITAK, Project Grant No: 108O593) for the financial support provided to this study.

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