Effect of Stocking Rate on Forage Availability and Growth Performance of Goat Kids in Mediterranean Kermes Oak Shrublands

***Turkay TURKOGLU [1], Sultan BEKIROGLU[2], Ahmet TOLUNAY[3]**
[1] Muğla Sıtkı Koçman University, Köyceğiz Vocational School, Muğla
[2] İstanbul University, Faculty of Forestry, Department of Forest Economics, İstanbul
[3] Süleyman Demirel University, Faculty of Forestry, Department of Forest Economics, Isparta
Sorumlu yazar: e-posta: turkayturkoglu@mu.edu.tr
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Abstract
This study aims to investigate the effect of stocking rate on forage availability (vegetation cover (VC) and forage mass (FM)) and the growth performance of pure hair goat kids (*Capra hircus* L.) in Mediterranean Kermes oak shrublands. Two villages that had the same ecological conditions but where the presence of pure hair goats did or did not exceed the grazing capacity were selected specifically within this scope. The birth weight (BW) and the daily live weight gain at 90 days (DLWG at 90 days) of pure hair goat kids in these villages were identified and compared in order to monitor their growth. As a result, there is a very strong positive correlation between the growth performance of goat kids, and VC and FM in these villages ($P<0.01$). Results indicated that high stocking rate effect forage availability and this situation cause decrease in the growth performance of goat kids. It was concluded that forage availability and stocking rate in grazing plans are points to consider providing sustainable goat farming.
Key words: Stocking rate, Forage availability, Growth performance, Pure hair goat, Kermes oak

Akdeniz Kermes Meşesi Makilik Alanlarında Otlatma Kapasitenin Yem Varlığına ve Oğlakların Gelişim Performansına Etkisi

Özet
Bu çalışmanın amacı, Akdeniz Kermes meşesi makilik alanlarında otlatma kapasitesinin, yem varlığı (vejetasyon kaplama ve yem kütlesi) ve kıl keçisi oğlaklarının (*Capra hircus* L.) büyüme performansları üzerine etkisini araştırmaktır. Bu kapsamda, kıl keçisi varlığı, otlatma kapasitesini aşan ve aşmayan aynı ekolojik özelliklere sahip iki köy örnek olarak seçilmiştir. Bu köylerde, kıl keçisi oğlaklarının büyüme performanslarını belirlemek için doğum ağırlığı ve 90 günlük ağırlıkları tespit edilmiş ve kıyaslanmıştır. Sonuç olarak, bu köylerde, kıl keçilerinin büyüme performansları ile vejetasyon kaplama ve yem kütlesi arasında çok güçlü pozitif bir ilişki olduğu bulunmuştur ($P<0,05$). Yüksek otlatma kapasitesinin, yem varlığını etkilemesinden dolayı oğlakların büyüme performansını olumsuz etkilediği tespit edilmiştir. Bu sonuçlara bağlı olarak, otlatma planlarında yem varlığı ve otlatma kapasitesi, sürdürülebilir keçi yetiştiriciliğini sağlamak için göz önünde bulundurulması gereken önemli noktalardır.
Anahtar kelimeler: Otlatma kapasitesi, Yem varlığı, Büyüme performansı, Kıl keçisi, Kermes meşesi

Introduction

The consumption of food is one of the most fundamental activities in all animals (Gordon, 2003). Grazing animals explore different forage resources to satisfy their daily nutrient needs, following specific spatial and temporal patterns (Evangelou et al., 2014; Yiakoulaki et al., 2014). Goats play an important socio-economic role in many rural areas of the world. These animals adapt easily to intensive production systems and convert their feed into highly nutritious milk and meat very efficiently (Castel et al., 2010). Therefore, goat farming is a traditional occupation and an important activity for nomadic societies, especially in the Mediterranean region of Turkey (Tolunay et al., 2014). Goat breeders living in these areas obtain a means of subsistence by selling high value products such as meat, milk and dairy products to urban consumers. Goats need nutrients derived from grazed forage in order to enhance extensive production systems so

that goats may produce high value products.

Goats are generally more selective than farm animals depending on the array and quality of plants available (Animut and Goetsch, 2008). They are the only domestic species that browse woody species and generally prefer leaves (Staaland, 1995). Goats are better climbers and spend more time on walking, ruminating, idling and other activities (Selemani et al., 2013). Therefore goats' diet and grazing behavior are different than other domestic ruminants (Wehn et al., 2011). Goats are well adapted to the consumption of shrubs inhabiting the Mediterranean forest understorey (Perevolotsky and Seligman, 1998; Mancilla-Leytón et al., 2013). In particular pure hair goats (*Capra hircus L.*), the most common goat species in Turkey (Bekiroglu and Tolunay, 2011) prefer browsing (Ashraf et al., 2014) and grazing on the shoots and leaves of the kermes oak (*Quercus coccifera L.*) (Tolunay et al., 2009a) that is a widespread and dominant species in the Mediterranean vegetation (Dumont et al., 1995; Papachristou, 1997). Kermes oak shrublands are the main feed source for goat flocks in many parts of the Mediterranean area. Available data suggest that kermes oak foliage is low in digestible protein and high in lignin and tannins. The nutritive value of this evergreen woody species varies with season (Salem et al., 2003). Pure hair goats, which bear the capacity to adapt to any type of land conditions and movement, generally prefer to feed in forests and rocky areas instead of flat meadows (Morand-Fehr et al., 2004; Papachristou et al., 2005). Compared with harvested or purchased feeds, kermes oak shrublands provide a relatively inexpensive and energy-efficient feed source for pure hair goat breeding.

Turkey has a forest area of nearly 22 million hectares, 99 % of which is state owned (Tolunay and Turkoglu, 2014). There are about 7 million forest villagers residing in more than 21,000 forest villages in Turkey. The goat breeding is an important and traditional source of income for these people in Turkey (Alkan and Korkmaz, 2009; Alkan et al., 2009; Alkan and Ugur, 2015). The kermes oak scrublands, covering more than 2.4 million ha, are suitable for grazing (Tolunay et al., 2009b). In Turkey, pure hair goat breeding had been conducted in an undisciplined and irregular manner until 2011. This was mainly due to the banning of pure hair goat breeding in forest areas by the state. A grazing plan was prepared by the state and conditions have changed pursuant to the government's permission of grazing goats in state forests. Thus, the number of the pure hair goats has increased dramatically in recent years. Currently, pure hair goat breeding is conducted in the form of free-range animal husbandry in shrublands. In line with these developments, it has become critical to develop a sustainable goat farming and benefitting optimally from the rich feed sources in Turkey.

Sustainability has been one of the main keywords of the establishment of grazing system. It means both sustainable rural incomes and also sustainable environmental responses to management systems, including biodiversity enhancement or maintenance. Overgrazing is an environmental problem in many favoured areas but in other less favoured areas undergrazing or absence of grazing is a big environmental, economic and therefore social problem resulting in the abandonment of these marginal areas (Milne and Osoro, 1997; Osoro et al., 2007). Thus stocking rate is one important management decision for goat breeders and grazing plan because stocking rate, as influencing forage mass, can affect grazing time and perhaps distance traveled depending on pasture size (Animut and Goetsch, 2008; Askar et al., 2013). The typical goat production system involves concentration of several large herds of goat in the communities and often surpasses the carrying capacity of these rangelands. The result is a severely overgrazed range in poor condition. An increase in stocking pressure generally represents a decrease in quantity and/or quality of forage available to grazing animals (Mellado et al., 2003). Some studies have described the relation between grazing capacity and diet composition. The study carried out by Mellado

et al. (2003) was about forage selection and botanical composition of goat diets under different stocking rate (high and low). The results of their study showed that goat herbivory reduces shrub and grass cover in the rangeland when goat density is high and goats on the high stocking rate were forced to alter diet selection pattern (Mellado et al., 2003). Diet selection, live-weight changes and productivity per hectare of two breeds of goats (Cashmere and local Celtiberic) managed in natural vegetation and the effect of stocking rate (high or low) in the Cashmere breed, were studied by Osoro et al. (2007). They described with that low abundance and poor quality of herbaceous plants it will be impossible to develop sustainable systems from the goat production point of view, and their management would need to be integrated during the grazing season by alternating with vegetation communities with better quality (Osoro et al., 2007). Askar et al. (2013) reported that nutritive value of forage, levels of forage mass above 1400 kg/ha achieved by different stocking rates would be of little or no benefit to performance of meat goats regardless of types varying in nutrient requirements. Khan and Naznin (2013) conducted a study to know the live weight gain of goats under semi-intensive conditions by using a linear regression model. They revealed that weight gain of goat depends on birth weight and balance feeding and management of kids. Osoro et al. (1999) stated that the optimum management response results from consideration of the interaction between the two principal factors: the vegetation dynamics and the animal. Previous studies showed that forage mass, grazing capacity and growth potential of goats are important in terms of sustainable grazing systems. Therefore, this study presents effect of stocking rates (high/low) on forage conditions and growth performance of pure hair goat kids in Mediterranean Kermes oak shrublands.

Objective and hypothesis of the study

The objective of this study was to determine the effect of stocking rate on forage availability and birth weight (BW) and the daily live weight gain at 90 days (DLWG at 90 days) of pure hair goat kids in in Mediterranean Kermes oak shrublands. In this context, two study areas that had same ecological conditions were selected to determine the effect of over and under grazing on forage availability and growth performance of goat kids. The purpose of this study is to develop sustainable goat farming in the Mediterranean Region of Turkey (Figure 1). It is necessary to identify the correlation between the FM and VC of the region with the growth of the goats feeding on these areas in the preparation of the grazing plans of the shrublands allocated for goat breeding. The hypothesis of study was the stocking rate has an effect on forage availability quantified in terms of VC and FM in shrublands, and growth performance of goat kids (BW and DLWG at 90 days).

Design and methods

Study area

This study was conducted in Isparta in the West Mediterranean Region of Turkey, at an elevation ranging between 950 m-1500 m and at 37° 47′ northern latitude, 30° 45′ eastern longitude. The tallest peak of the Davras Mountain is 2637 m high. The long-term average annual rainfall is 511 mm and the mean air temperature is 12 ºC. During the winter (December-March) and summer (June-September) seasons, the mean air temperature ranges from 1.8 to 5.9 ºC and 18.3 to 23.5 ºC while the rainfall ranges between 52.6 and 74.9 mm and 12.0 to 28.7 mm, respectively. The climate of the area is characterized as semi-arid with cold winters. The soil texture is clay to wet clay, derived from conglomerates of the Mesozoic period and colluvials from the river or torrent bank deposits (Atalay, 2006). Average organic matter content ranges between 2.6 and 3.6 % and and average pH is 7.2 (Babalık, 2006). The Davras Mountain is located in the Mediterranean and Iran-Turan

transitional band from a phytogeographic perspective. According to the forest management plan data, the overall area covered in the study is 10,068.0 ha; 6,804.0 ha of this land is composed of degraded woodland, 605.0 ha of non-forest land, 205.5 ha of rock areas, 185.5 ha of settlement areas, 5 ha of water dam and 2,263.0 ha of agricultural land. Kermes oak is present as the main shrub type within the area qualified as degraded woodland in the plans of forest management. This type of shrub is sporadically accompanied with Crimean juniper (*Juniperus excelsa* Bieb.) and hawthorn (*Crateagus monogyna* Jacq). Furthermore, there are also single-year herbaceous taxons such as gum plants *(Euphorbia L.)* and mullein *(Verbascus L.).*Villagers who breed pure hair goats have settled on the accommodating skirts of the Davras Mountain. These settlement units are the villages of Savköy, Büyükhacılar (BH), Küçükhacılar, Aliköy, Küçükgökçeli, Büyükgökçeli and Çobanisa (CI), all of which are old settlements. Nomadic people played an important role in the settlement process. The main occupation of the villagers is farming and livestock breeding. Villagers breed livestock for household consumption and commercial purposes. The Davras Mountain area is the district where most problems are experienced in pure hair goat grazing in the province of Isparta. The shrub variety displaying a native range within the study area is the Kermes oak. The land coverage rate of Kermes oak ranges between 70 and 90% while the shrub height ranges between 50 cm and 150 cm (Tolunay et al.,2009c).

Table 1. Goat capacity of the study areas*

Villages	Total village land	Total forest land	Allowed grazing land	Vegetation cover	Optimum goat capacity	Current goat capacity	Optimum Goat capacity per ha	Current goat capacity per ha	Status (More/less Goats number)
	ha	*ha*	*ha*	*%*					
BH**	2,811.9	2,025.6	1,905.9	66.66	4,765	8,095	2.5	4.3	+3,330
CI**	5,680.0	4,345.2	2,761.5	71.33	8,285	5,090	3.0	1.8	-3,195

* Adapted from Tolunay et al. (2014)
** BH: Büyükhacılar Village, CI: Çobanisa Village.

The villages BH and CI were designated as the study areas among the rural settlements within the study area. These villages both had the same socioeconomic and ecological conditions. The goat capacity of the study areas are given in Table 1. Although the optimum goat capacity of the village BH is 4,765; current goat capacity is 8.095. This is not the case in the village CI, while optimum goat capacity of CI village is 8,285; there are 5,090 pure hair goats. However while the optimum grazing capacity is 2.5 goats/ha in the village BH, the current rate is 4.3 goats/ha; the optimum grazing capacity in the village CI is 3.0 goats/ha and the current rate is 1.8 goats/ha. This is the main reason for the selection of these villages in this study.

Measurements

In this study, the BW and DLWG at 90 days of pure hair goat kids, and VC and FM measurements were performed in the study areas of BH and CI Villages in 2014.

Birth weight of pure hair goat kids (BW): The weight at birth of 30 kids born on the same day in the villages BH and CI selected as study areas.

Daily live weight gain at 90 days (DLWG): The weight of the same 30 pure hair goat kids after 90 days in the BH and CI villages.

Forage mass (FM): Two experimental areas were selected within both villages bearing the same site traits (aspect, elevation, slope, soil, etc). Within these areas, kermes oak shrubs spread over an area of at least 10 m^2 were identified and 30 shrub plots carrying those traits were selected at random. The average of 10 samples was taken from each plot and thus the forage mass of that plot was found. Samples were derived from 30 shrub plots (30 plot x 1 m^2 = 30 m^2) and green leaf and shoot samples were obtained from a total land area of 300 m^2 (30 plots x 10 m^2 = 300 m^2). A sampling quadrant of 1m x 1m was created by using wooden slats. Representative hand-plucked forage samples similar to those consumed by animals were collected (Cook, 1964). Green herbage samples that had been collected were weighed freshly and numerical data was obtained for samples derived from 30 Kermes oak shrub plots. These measurements were performed in June.

Vegetation cover (VC): In areas where pure hair goat grazing was conducted, 30 random trial plots of land of 10 m x 10 m = 100 m^2 were selected from both villages. The kermes oak land VC rate (%) in each plot of land was measured. Kermes oak land coverage rate in each plot of land was measured; the average of the measurements was taken to determine the land coverage rate of the trial land. Some parts of the measured fields were those where kermes oaks spread sparsely and which were indicated as forestless soil on the forest management plans. The quantity of these areas was identified and the rate of closure was accepted as 10%. The closure rates (%) obtained as a result of the measurements made in the trial areas (ha) and the size of the fields whose closure is accepted as 10% were taken into account and the kermes oak area coverage rates were identified. These closure rates were used to calculate the optimum number of goats that may be grazed in 1 ha land and optimum number of animals that may be fed in 1 year in the forest lands where grazing is allowed for villagers. The current number of pure hair goats retrieved from the records of Isparta Provincial Agricultural Directorate and the optimum number of animals were compared to identify the villages where there are goats numbers above and below the grazing capacity (Tolunay et al. 2014).

Data, symbols and statistical analyses

The measurements in relation with the variables of VC and FM and the BW as well as the DLWG at 90 days in pure hair goat kids located in the villages BH and CI constitute the main materials of this study. Data types and its symbols are given in Table 2.

Table 2. Variables utilized in the research

Symbol	Name of variable	Symbol	Name of variable
X_{BH1}:	BH-Birth weight (kg)	X_{CI1}:	CI-Birth weight (kg)
X_{BH2}:	BH-Daily live weight gain (kg)	X_{CI2}:	CI-Daily live weight gain (kg)
X_{BH3}:	BH-Vegetation cover (%)	X_{CI3}:	CI-Vegetation cover (%)
X_{BH4}:	BH-Forage mass (kg)	X_{CI4}:	CI-Forage mass (kg)

The statistical analyses of the study were conducted using the Statistical Package Program (SPSS 20) and the results were verified at a significance level of 5%. Firstly, the normality test was performed in order to identify parametric and non-parametric statistical methods would be used in the study. As the number of observations was 30, the use of the Kolmogorov-Smirnov Test was preferred. The results of the compliance test villages BH and CI and those with a normal distribution are provided in Table 3.

Table 3. Normality test results

		X_{BH1}	X_{BH2}	X_{BH3}	X_{BH4}	X_{CI1}	X_{CI2}	X_{CI3}	X_{CI4}
N		30	30	30	30	30	30	30	30
Normal Parameters[a,,b]	Mean	3.11	17.88	66.66	337.00	3.517	20.02	71.33	487.33
	SD	.53	4,36	9.94	180.53	.44	4.40	10.08	214.4
Most Extreme Differences	Absolute	.131	.100	.165	.123	.118	.080	.205	.125
	Positive	.076	.100	.165	.123	.093	.080	.170	.125
	Negative	-.131	-.100	-.147	-.103	-.118	-.071	-.205	-.073
Kolmogorov-Smirnov Z		.718	.550	.901	.675	.647	.439	1.123	.683
Asymp. Sig. (2-tailed)		.681	.922	.391	.752	.796	.990	.160	.739

a.Test distribution is normal, b.Calculated from data, SD: Standard Deviation

Table 3 demonstrates that Asymp. Sig. (2-tailed) values are higher than 5% for all variables (p*>0.05). In this case, the distributions of variable datasets are compliant with the normal distribution. Thus, it was decided to identify the difference of the two villages in terms of pure hair goats with Paired Samples T-Test. The paired sample t-test can be used to compare two population means in the case of two different samples but related conditions or units. Paired two groups were assumed as one group and means related to the two measurements were compared. The correlation between the growth performance variables on a village basis (BW and DLWG at 90 days) and the variables of the capacity of the vegetation to feed pure hair goats (VC and FM) was determined with the Correlation Analysis.

Results and Discussion

Results of measurements

The results of the descriptive analyses relating to the variable datasets of the villages BH and CI are shown in Table 4. The number of pure hair goats in the village BH was 8.095, while this number was CI in 5.090 (Table 1). The average BW of pure hair goat kids in BH and CI villages were 3.11±0.53 and 3.51±0.44 kg, respectively. The average BW of pure hair goat kids is 400 g more in the village CI compared to the other village. The average DLWG at 90 days of goat kids in BH and CI villages were 17.88±4.36 and 20.02±4.40 kg, respectively. A similar study was carried out by Cemal et al. (2013) about BW and growth performance of pure hair goat kids in Denizli Province of Turkey. They found that BW and LW at 150 days were found as 3.29 kg and 27.15 kg, respectively (Cemal et al., 2013). Different study on growth performance of black Bengal and Jamunapari goat kids in semi intensive conditions in Bangladesh showed that while average BW of black Bengal and Jamunapari goat kids were 1.42 and 1.51 kg, the average weaning weight at 120 days of black Bengal and Jamunapari goats were 5.63 and 6.79 kg, respectively (Khan and Naznin, 2013).

Table 4. Descriptive statistics

	X_{BH1}	X_{BH2}	X_{BH3}	X_{BH4}	X_{CI1}	X_{CI2}	X_{CI3}	X_{CI4}
N	30	30	30	30	30	30	30	30
Mean	3.11	17.88	66.7	337.00	3.52	20.02	71.33	487.3
Minimum	2.1	10.6	50	80	2.2	12.7	50	140
Maximum	4.0	24.9	80	690	4.4	27,4	90	890
Std. Deviation	0.53	4.36	9.94	180.53	.44	4.40	10.08	214.4

The results of the Paired Samples T-Test analysis demonstrating whether villages BH and CI are different in terms of forage mass, the BW and DLWG at 90 days of pure hair goat kids have been provided in Table 5.

Table 5. Paired samples t-test statistics

		Mean	SD	SEM	Lower	Upper	t	df	P
Pair 1	BH-Forage mass CI-Forage mass	-150.33	45.52	8.31	-167.33	-133.33	-18.09	29	.000*
Pair 2	BH- BW of goat kids CI- BW of goat kids	-.403	.193	.035	-.475	-.330	-11.39	29	.000*
Pair 3	BH-DLWG at 90 days CI- DLWG at 90 days	-2.143	.347	.063	-2.272	-2.013	-33.82	29	.000*

*P<0.01, SD: Standard deviation, SEM: Standard error mean

The fact that the values in Sig. column (P values) of Table 5 are 0.000 demonstrates that the difference arising from the compared variables of these two villages is statistically significant (Sig. <0.01). In other words, although the study areas had the similar VC statistically, FM and growth performance pure hair goats in the villages BH and CI are not similar.

Effect of the stocking rate on forage availability and growth performance of goat kids

The results of the analysis relating to growth performance of pure hair goat kids and vegetation traits in both villages are given in Table 6.

Table 6. Results of the correlation analysis

BH Village					
		X_{BH4}	**X_{BH3}**	**X_{BH2}**	**X_{BH1}**
X_{BH4}	Pearson Correlation	1	.960**	.985**	.951**
	Sig. (2-tailed)		.000	.000	.000
X_{BH3}	Pearson Correlation	.960**	1	.964**	.947**
	Sig. (2-tailed)	.000		.000	.000
X_{BH2}	Pearson Correlation	.985**	.964**	1	.968**
	Sig. (2-tailed)	.000	.000		.000
X_{BH1}	Pearson Correlation	.951**	.947**	.968**	1
	Sig. (2-tailed)	.000	.000	.000	
CI Village					
		X_{CI4}	**X_{CI3}**	**X_{CI2}**	**X_{CI1}**
X_{CI4}	Pearson Correlation	1	.927	.983**	.936**
	Sig. (2-tailed)	.000	.000	.000	.000
X_{CI3}	Pearson Correlation	.927	1	.948**	.921**
	Sig. (2-tailed)	.000	.000	.000	.000
X_{CI2}	Pearson Correlation	.983**	.948**	1	.937**
	Sig. (2-tailed)				
X_{CI1}	Pearson Correlation	.936**	.921**	.937**	1
	Sig. (2-tailed)	.000	.000	.000	

**Correlation is significant at the 0.01 level (2-tailed), N=30

Results demonstrate that there is a very strong correlation between the variables of the BW and DLWG at 90 days, and the VC and the FM. It has been known that the BW, DLWG and average daily gain were influenced by species, gender, type of birth, age of the dam

and birth season (Khan and Naznin, 2013; Cemal et al., 2013; Jimenez-Badillo et. al., 2009) and some environmental factors are also important on growth performance of goats. A large quantitiy of nutrition has a significant effect on growth performance of goats (Wilson, 1958; Ash and Norton, 1987; Yagoub and Babiker, 2008; Kabir et al., 2014). Moreover, Choi et al. (2006) revealed that goats fed oak browses were better in growth performances determined by average daily gain, feed efficiency or feed intake than those fed rice straw or pine browse. The FM in village CI are higher than those of village BH. The VC of CI was approximately 10% higher on average compared to that of BH while the FM was 150 kg higher on average than that of BH. Thus, a surplus of 400 g in BW and 2.14 kg in the 90-days weight of goats resulted from high quantity of VC and FM in the CI village. These results are in good agreement with the above-mentioned researchers' findings. Moreover, a statistically positive and significant correlation was detected also between the variables of BW and DLWG at 90 days of pure hair goats and the variables of VC and FM of these villages.

The results of study indicate that the high stocking rate has significant negative effects on VC and FM and this situation cause decrease in the growth performance of goat kids. In other words, it was determined that in regions with a high FM, the growth performance of pure hair goats was higher due to a good alimentation. As a result of this, forage availability is an important factor in the growth performance of pure hair goat kids. This is because, pure hair goats have been raised above the optimum grazing capacity in the village BH, while pure hair goats have been raised below the optimum grazing capacity in the village CI. Thus, the hypothesis of the study proved to be right and stocking rate has an effect on forage availability and growth performance of goat kids in Mediterranean Kermes oak shrublands. The high stocking rate would not allow the development of sustainable goat production system (Mellado et al., 2003). In this study, the forage availability of BH Village was observed to be degraded due to overgrazing or high stocking rate. This finding is consistent with that of Manzano and Navar (2000). Grazing lands are the most degraded land use type in the world as a result of overgrazing (Papanastasis, 2009) which leads to the impoverishment of species composition, reduction of VC, exposure of soil to erosion, and ultimately to desertification (Thornes, 2007; Aksakal et al., 2011; Kiage, 2013). Vegetation cover is important in the ground to protect soils from exposure and overgrazing has been destroying this protective vegetation. Ramirez (1999) explained that low forage availability constraints efficient production of livestock on rangeland where low intake is the most common factor. This emerges as an indicator of the inability to perform sustainable goat farming in the study areas. It is known that the scrublands in Turkey were preserved by means of grazing for a very long time. However, changing socio-economic conditions may lead to overgrazing in some regions while giving rise to under-grazing in other regions. Overgrazing destroys rangelands while under-grazing leads to the spreading of shrubs and reduction in biodiversity. The subsistence of the villagers located in the rural settlement areas of the Davras Mountain in Turkey depends on the breeding of pure hair goats. Unless sustainable goat farming is established undesirable environmental and socio-economic results may occur. As a result villagers may have a tendency to quit pure hair goat breeding which has been traditional practice for centuries (Bekiroglu and Tolunay, 2010a; Bekiroglu and Tolunay, 2010b).

Conclusions

This study demonstrated that stocking rate has an effect on the forage availability and growth performance of goat kids in term of BW and DLWG at 90 days in Mediterranean Kermes oak shrublands. The presence of pure hair goats in the study areas has an impact on the rangeland vegetation. There is a very strong positive correlation between the pure hair goat

growth performance, and VC and the FM in these villages. The forage availability is an important factor in the growth performance of pure hair goat kids. Overgrazing is an environmental problem in the BH Village but in other study area, CI Village, under-grazing can constitute environmental, economic and social problem for villagers. Because of this sustainability is important in goat farming system or grazing system by means of both sustainable rural incomes and also sustainable environmental responses to management systems. It is necessary to end the damage on vegetation by reducing the presence of pure hair goats in villages where capacity is exceeded. It is also necessary to increase the presence of pure hair goats in rangelands where under-grazing happens in order to provide a positive contribution to the economic status of villagers and the rangeland biodiversity. This is absolutely necessary for a sustainable goat farming system. It was concluded that forage availability and stocking rate in grazing plans are points to consider providing sustainable goat farming.

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