Evaluating the browsing levels of Saanen, Honamlı and Turkish Hair goats on saplings in a forest plantation area

Avaliação do navegação de cabras de Saanen, de Honamlı e de Turco Hair mudas na área de plantio florestal

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Highlights

Differences between breeds in terms of browsing towards untreated saplings were determined.
The ratio of browsing for saplings treated with shading was considerably low.
Damage rate of shoots treated with shading in particular was apparently determined to be lower.

Abstract

The study was conducted to comparatively investigate the browsing levels of Honamlı, Hair and Saanen goats on saplings in a new forest plantation site for six months. Several treatments (fishing net, shading, food colouring and raffia) were applied to saplings. Thirty two-year-old goats, including 10 animals for each breed were used. There was a statistically significant difference among the breeds in terms of their browsing on untreated saplings ($p < 0.05$). While the effect of measurement month was statistically significant ($p < 0.05$) for both all treated saplings and untreated saplings, the observation time did not have a statistically significant effect ($p < 0.05$), except for saplings treated with shading. The maximum browsing was observed in saplings treated with raffia (89.28%), which was followed by those treated with food colouring (75.79%) and fishing nets (75.39%), respectively. Additionally, the damage rate of the saplings with shading (17.85%), in particular, was significantly lower ($p < 0.05$) compared to the other treated saplings. It was thought that the results of this study would contribute to the issue of goats, saplings and forests from a different viewpoint. Considering that forests and goats are not alternatives to each other, evaluating goats as a part of the ecosystem will be useful in solving this problem.
Key words: Browsing. Forest. Goat. Planting. Sapling.

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Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022

1469

Resumo

No estudo, objetivou-se determinar os níveis de interesse das cabras de Honamli, de cerdas e Saanen na nova área de plantio florestal por seis meses. Diversos processos (rede de pesca, sombreamento, corante alimentar e ráfia) foram aplicados às mudas. No estudo, foram utilizados 30 cabeças de cabras, 10 cabeças de cada raça. Observou-se que a diferença entre as raças foi estatisticamente significante em termos de mudas para mudas vazias (p < 0.05). Enquanto o efeito de meses medido na orientação para mudas foi estatisticamente significativo para todas as aplicações e mudas vazias (p < 0.05); determinou-se que o tempo de observação não apresentou efeito estatisticamente significante (p < 0.05) para outras aplicações, exceto para orientação às árvores aplicadas no dossel. A navegação máxima foi observada nas mudas tratadas com ráfia (89,28%), seguidas pelas tratadas com corante alimentar (75,79%) e rede de pesca (75,39%), respectivamente. Além disso, a taxa de interesse em árvores com copa aplicada (17,85%) foi significativamente menor do que em outras aplicações (p < 0.05).Pensa-se que os resultados desta pesquisa possam contribuir para questões de cabras, mudas e florestas com uma perspectiva diferente. Floresta e cabra não são alternativas entre si e a avaliação de cabras como parte do ecossistema; contribuirá positivamente para o problema atual.

Palavras-chave: Cabra. Floresta. Muda. Navegacao. Plantio.

Introduction

Allowing animals to exhibit their natural behaviours is important in terms of meeting their needs (Spinka, 2006). When the issue is approached from this perspective, it is significant to reveal goats' patterns of behaviour in areas in and around forests found in their natural habitats.

Goats have a feeding behaviour quite different than other farm animals and can feed on numerous plant species including bushes, briers and maquis (Bateman et al., 2004). They have a preference for grazing and browsing on fresh grass and maquis shoots. As long as maquis shoots are consumed properly, this strengthens bushes, ultimately affecting their sustainability, as well as ensuring plant diversity (Ngwa et al., 2000; Dziba et al., 2003).

Goat-forest relationships also had an important place in decreasing number of goats in previous years. Sanctions imposed on goat breeders in villages around the forest have been disadvantageous to goats and goat breeders for years. When goats are considered a natural component of temperate climate zone, in particular, the decrease in the existence of goats inevitably creates a serious problem for persons living in this ecosystem and earning a livelihood in this way (Dellal & Erkus, 2000). This relationship should be evaluated in more detail, especially in terms of keeping the rural population in the region.

Depending on the decreases in plant production made for food and feed purposes, it is suggested that extensive breeding based on native breeds should not be completely abandoned. In this case, the insurance of animal breeding will be the genetic resource of indigenous breeds. The Hair goat (Anatolian Black) is spreading in all the regions of Turkey (General Directorate of Agricultural Research and Policies [GDARP], 2011). While Honamlı goats are reared in especially the

1470

Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022

Evaluating the browsing levels of Saanen, Honamlı and Turkish Hair...

Ciências Agrárias
SEMINA

Mediterranean region of Turkey, Saanen goats, which are one of the most popular dairy goat breeds, are also reared in this region.

While many reasons have been adjudged for the reduction in the number of goats in Turkey, the goat-forest relation is one of the major impacting factors among such reasons. It should be kept in mind that goats can damage young tree saplings, which both are more sensitive to environmental changes and have higher mortality rates than mature trees (Grogan et al., 2011) in grazing areas. Domestic goats are perceived as enemies of forests, blamed for much of the destruction of the Mediterranean forests and are not allowed to step in forested areas. At this point, the damage that they cause to young saplings comes to the forefront. It is reported that young saplings have deformations and structural defects in forestry due to the effect of climbing of ruminants and this situation inhibits the growth of saplings (Türkoğlu et al., 2016). Uncontrolled goat grazing is reported to have negative effects on forest regeneration and maquis in the Mediterranean region, where the growth of most saplings is typically slow because of the undesirable

impact of ungulates (Lovreglio et al., 2014; San Francisco Estuary Institute [SFEI], 2020).

The study aimed to compare the browsing levels of Saanen goats towards saplings in the forest plantation site with local goat breeds: Hair and Honamlı. Additionally, this study endeavoured to bring clear observed data for the debate on the relationship between goats and forests.

Materials and Methods

The study area, animals and data collections

In the study, the browsing levels of three breeds of saplings in the forest plantation sites were examined comparatively. The study was carried out at a forest plantation site of 1.000 m2 (Figure 1) located in the province of Burdur in Mehmet Akif Ersoy University İstiklal Campus (36°53'N to 37°50'N, 29°24'E to 30°53'E). A total of 30 goats (two years old) including 10 goats from each native Honamlı and Turkish Hair goat as ones of native goat breeds and Saanen goat which was obtained from a trading enterprise were used.

Figure 1. The forest plantation sites.

Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022

1471

The flocks were reared mainly under extensive conditions. While kermes oak (Quercus coccifera) prevailed mostly in maquis shrubland, formations from cultures of the green olive tree (Phillyrea latifolia), black pine (Pinus nigra), Calabrian pine (Pinus brutia) and cedar (Cedrus) were also found in rangelands. The goats were pastured and kept out for a minimum of 8 hours a day from early in the morning till noon except during the observation period of study. Then, the flocks were allowed to rest under the shade during noon. Thereafter, they were allowed to graze after the blaze of the sun subsided. At the end of the day, the flocks were back to their respective blocks. A supplemental food (16% crude protein and 2500 kcal metabolisable energy per kg dry matter) was also given to the animals for about two months during harsh climate conditions to support their endurance. During the study, any type of prevention and control applications (vaccines and anthelmintic medicines, among others) regarding their health were completely performed.

During the observation period, ten goats from each genotype were allowed to enter the forest plantation site. Seven Honamlı, Turkish Hair and Saanen goats were randomly chosen, and each genotype was observed and recorded using momentary time sampling with intervals of 15 minutes, including the procedure with frequency counting during visual observation (Tölü et al., 2012; Mohapatra & Panda, 2013; Wilder et al., 2021).

Several treatments (fishing net, shading, food colouring and raffia) were applied to saplings in a new existing forest plantation site (Figure 2). The treatments were intended to restrain goats from biting and chewing the apical part of saplings, so all saplings were covered with applications as close down their apical parts.

In the study, only the browsing levels of the goats and not the other different behaviour types such as grazing, resting, bipedal stance and rumination, towards treated and untreated saplings, were determined. The goats were randomly selected at each observation time. Observations were performed in 3-day periods as 1 day a month for each breed for 6 months (April-September). During these observations, goats' tendencies to directly go to the saplings and their browsing and eating attempts on the shoots of saplings were recorded by an observer for each genotype with time sampling at 15-minute intervals. During the remaining time of the interval, the observer coded the frequency of the event behaviours as they occurred. These orientations took 7 hours, including two 3.5-hour periods in the morning (8h30-12h00) and the afternoon (14h00-17h30).

The study was approved by Mehmet Akif Ersoy University Local Ethical Committee on Animal experiments (meeting number: 14, resolution number: 89).

Evaluating the browsing levels of Saanen, Honamlı and Turkish Hair...

Ciências Agrárias
SEMINA

Fishing Net

Shading

Raffia

Food Colouring

Figure 2. The treatments applied to saplings.

Statistical analysis

Different levels of browsing intensity for goats have been mentioned by several researchers (Glasser et al., 2012; Mancilla-Leytón et al., 2013; Manousidis et al., 2016; Chebli et al., 2020). However, in a forest area, this situation is rare. The methodology and sample size for goats for lower herbivory pressure developed for the present study were based on data specifically from planted forests and taking into consideration all the factors included in the calculation of the carrying capacity (Papanastasis, 1986; Evlagon et

Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022

1473

al., 2012). In addition to this, a browsing management strategy was designed to easily control the location and extent of the plant parts removed for carrying capacity for this purpose. The acceptability of defined sample size according to carrying capacity was also tested by the power and sample size tool by using the 19.1.1 version of MINITAB (2019) statistical package software. Transformed data were analysed by the analysis of variance (ANOVA) generalised linear model (GLM) procedure for the determination of effects on the interest levels of saplings. However, Tukey analysis was employed in controlling the significance of differences between sub-groups ($p < 0.05$). No statistically significant interactions existed between any of examined factors. In addition to this, the Chi-Square test was used for statistical evaluation of the data to compare behaviour characteristics of goat breeds.

Results and Discussion

Table 1 shows the effect of breed, observation time and measurement month on behavioral patterns of the goats such as browsing on saplings and eating shoots, among others. Table 1 shows that Saanen, Turkish Hair and Honamlı breeds showed browsing on the saplings with all applications in different levels. The difference between the breeds was not statistically significant in terms of browsing on raffia ($p > 0.05$). Meanwhile, the effect of the measurement month on browsing on saplings was statistically significant for all treatments ($p < 0.05$), and the observation time (morning-afternoon) did not have any statistically significant effect on the other treatments, except for shading treatment. All genotypes displayed more browsing on untreated ones than the treated saplings. The Saanen goats showed more browsing on untreated saplings compared to Honamlı and Turkish Hair goats.

Table 2 shows the goats' browsing on all of the treated saplings (fishing net, shading, food colouring and raffia) and untreated saplings and alongside the significance levels between the treatments. Based on this table, the goats browsed on untreated saplings during the measurement month and all of the observation times with a rate of 100%. Maximum browsing was observed in saplings with raffia (89.28%), which was followed by those with food colouring (75.79%) and fishing nets (75.39%), respectively. In addition, the rate of browsing on saplings with shading was significantly lower (17.85%).

Evaluating the browsing levels of Saanen, Honamlı and Turkish Hair...

Ciências Agrárias
SEMINA

Table 1
The effective factors on goats' behaviors in the forest plantation site

Factors	Fishing Net	Shading	Food Coloring	Raffia	Untreated sapling
Breed					
Saanen	0.95[b]	0.13[b]	1.37[a]	1.67	3.19[a]
Turkish Hair	1.17[a]	0.31[a]	1.24[ab]	1.59	2.58[b]
Honamlı	0.94[b]	0.14[b]	1.17[b]	1.46	2.43[b]
P	*	*	*	NS	***
Observation time					
Morning	1.02	0.25	1.25	1.50	0.08
Afternoon	1.03	0.14	1.27	1.64	0.09
P	NS	*	NS	NS	NS
Measurement month					
April	1.55[a]	0.31[ab]	1.74[a]	1.83[a]	3.26[a]
May	1.00[bc]	0.36[a]	1.26[b]	1.57[abc]	2.76[ab]
June	1.07[abc]	0.14[ab]	1.33[b]	1.74[ab]	2.57[b]
July	0.48[d]	0.07[b]	0.64[c]	1.21[bc]	2.21[b]
August	0.66[cd]	0.07[b]	1.19[b]	1.07[c]	2.28[b]
September	1.38[ab]	0.21[ab]	1.38[b]	1.98[a]	3.30[a]
P	***	*	**	***	**

a,b,c,d: Values in the same column with different superscripts are statistically different (P < 0.05)
NS: nonsignificant (p > 0.05). *: p < 0.05, **: p < 0.01, ***: p < 0.001.

Table 2
Browsing levels of the goats on saplings in the forest plantation site

Treatments	Browsing Levels	
	Browsing (+) (%)	Browsing (-) (%)
Fishing net	75.39	24.61
Shading	17.85	82.15
Food coloring	75.79	24.21
Raffia	89.28	10.72
Untreated sapling	100.00	00.00
P	***	

***: p < 0.001.

Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022

1475

Table 3 shows the goats' browsing of the treated saplings in terms of breeds. Here, it was found that browsing levels on saplings covered with a fishing net were 66.6, 79.76 and 79.77% for Saanen, Turkish Hair and Honamlı goats, respectively. These values were detected as 11.90, 27.38 and 14.28% for Saanen, Turkish Hair and Honamlı goats, respectively, for the shading treatment.

Table 3
Browsing levels of the goats on saplings in the forest plantation site in terms of breeds

	Browsing Levels					
	Browsing (+) (%)			Browsing (-) (%)		
	Saanen	Turkish Hair	Honamlı	Saanen	Turkish Hair	Honamlı
Fishing net	66.60	79.76	79.76	33.40	20.24	20.24
Shading	11.90	27.38	14.28	88.10	72.62	85.72
Food coloring	75.00	72.61	79.76	25.00	27.39	20.24
Raffia	86.90	95.23	85.71	13.10	4.77	14.29
Untreated sapling	100.00	100.00	100.00	0.00	0.00	0.00

Several researchers have examined the impact of livestock grazing, especially its intensity, and have investigated grazing avoidance strategies related to the functional diversity of community-level plant trees (Le Brocque et al., 2009; Carlucci et al., 2012; Catorci et al., 2014; Ford et al., 2018). Even though there are different approaches toward grazing management of ungulates, especially goats, the number of studies on methods preventing sapling consumption is limited.

While there were other behavioural traits such as grazing, resting and rumination, as mentioned before, only the browsing levels were detected in the present study because of the main object of study and the restricted area of 1.000 m². Saanen goats were observed to show more browsing, especially for saplings with food colouring compared to Honamlı goats. Similarly, Turkish Hair goats preferred to browse saplings with

shading and fishing net more than the other two breeds. The damage rate of saplings with shading, in particular, was significantly lower compared to the other treatments. In turn, it can be proposed that Turkish Hair goats had browsing on saplings treated with shading because they have more explorative and stubborn characters compared to the other breeds according to visual observations. It was observed that Saanen and Honamlı goats gave up browsing on saplings with shading within a short period. They did not also show much browsing on the other treated saplings after a short-term interest, and instead spent most of their time grazing, resting and so on. This case held true for Turkish Hair goats, as well. Similarly to this, it is reported that grazing behaviour, which affected the browsing levels of saplings indirectly in the study, may vary between 60% and 85% (El Aich et al., 2007). In addition to this, grazing behaviour is known

1476

Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022

Evaluating the browsing levels of Saanen, Honamlı and Turkish Hair...

Ciências Agrárias
SEMINA

to vary depending on the season and hours within a day (Dziba et al., 2003; Beker et al., 2009).

In the study, the goats with the same physiological condition were allowed to the forest plantation site at the same observation time to obtain behavioural differences arising from only genotypes as much as possible. Goats generally browsed treated saplings in the first hours of observation times (morning and afternoon) in the forest plantation site. They were resting and grazing at the observation site during the remaining time. Pine forests and shrublands are arranged based on a plan in many European countries. This suggests that if bushes are present in the surrounding area, they can also be eaten by goats. Unless goats suffer from a lack of food, they do not eat coniferous trees and leaves, and their effect on coniferous trees does not exceed 5% in non-intensive grazing (Soya, 2006).

"Preparing action plans for decreasing the number of goats" is based on the perception that goats are the enemy of the forests. Revealing behavioural patterns of goats in forested areas will present objective data for a general approach to goats. This is the first study on behavioural patterns of Honamlı goats. The number of behavioural studies on Hair goats is also limited; therefore, the results of the present study will provide a data archive for further studies. In addition, it is thought that comparing behaviors of Saanen goats with Honamlı and Turkish Hair goats is one of the important outcomes of the project since Saanen goats are mostly reared extensively and cannot be bred in forests, shrublands and maquis areas.

Conclusion

The results represent scientific data related to goats, grazing, forests and maquis and thus addressed the disputes more objectively. The study has revealed that it is required to elaborately examine factors such as the condition of herbaceous plants influencing attitudes of goats towards bush and saplings as well as grazing time and season.

It was shown that goats need forests because of woody understorey vegetation. However, forests need goats for stable ecosystems, too. Their relationship was impacted by ecological and silvicultural fundamentals. Goats can be allowed to enter forests with large grass depending upon the season. It is thus recommended that where goats are used in conjunction with other grazing animals, correct stocking rates should be adhered to. Different breeds can be used for forested areas having various sizes in different regions. Research on the management and use of tree foliage should be encouraged to reach a balance between the feeding of tree forages and the environment. It is required to find ways to optimally utilise every farm animal, including goats, to support animal products. Evaluating goats as a part of the ecosystem would make a positive contribution to this issue. This study wanted to touch on part of the big problem between goats and forests to bring the discussion into the scientific area. Both stakeholders of the problem are not exclusive to each other. Furthermore, goats have to be reared in or near the forest according to their behaviourally detailed features to make a contribution to the red meat sector and to keep the rural population

on their land. Therefore, In the meantime, more research is needed about the nutritive value of the forest vegetation to goats under actual grazing conditions for understanding the technical aspects of goat grazing in the forest plantation area. Additionally, It is required to determine the morphological, physiological and behavioral characteristics of these animals; to examine which environments and aspects they need to be utilised.

Acknowledgements

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1478

Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022

Evaluating the browsing levels of Saanen, Honamlı and Turkish Hair...

SEMINA
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1480

Semina: Ciênc. Agrár. Londrina, v. 43, n. 4, p. 1469-1480, jul./ago. 2022