American-Eurasian J. Agric. & Environ. Sci., 11 (2): 177-182, 2011
ISSN 1818-6769

Investigating the Effect of Climatic Conditions and Different Stages of Growth on the Preference Value of *Bromus tomentellus* in the Semi-Steppe Rangeland of Iran by Sheep

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Abstract: Selection of plants by livestock depends on forage and climatic conditions. In this study, the effect of climatic conditions and different stages of growth on the preference value of *Bromus tomentellus* for sheep in semi-steppic region was investigated. Preference value of *Br. tomentellus* was studied in spring and summer seasons of 2007 and 2008 in four semi-steppic sites of Sahand (East Azerbaijan), Firozkoh (Tehran), Jashlobar (Semnan) and Badamestan (Zanjan). To determine the preference value, the percentage of utilization method was used. The vegetation cover data was collected for 1 square meters in each month through random-sampling method. To compare Preference value of species in different habitats and various stages of growth, the combined analysis randomized complete block design was used. The results of this study showed that the effect of habitat factor was significant at 1% and the climatic conditions factor was significant at 5%. But, the other factors were insignificant. The results of the study showed that species composition and quantity of available forage were effective factors in the changing preference value. As a result of this, the preference value of species was variable and it depends on habitat and climatic characteristics.

Key words: Preference Index · Grazing Season · Bromus Tomentellus · Rangeland · Utilization · Livestock

INTRODUCTION

One of the most important factors for management the grazing in rangelands, is determination the preference value of vegetation. It is the best tools to manage the severity exploitation of a species in comparison to other species in the composition of rangeland vegetation [1]. Preference value or selection means, choose a plant over other plants by livestock which is a mainly behavioral response [2]. Preference value is an effective index in the livestock ability to select and graze the plant. Preference is a complex phenomenon which is determined by animals, plants and the environment diversion which occurs in different parts of a plant or its different organs [3].

There are many effective factors on preference value including the livestock behavior and environmental factors. The stage of plant growth is the most affecting factor on composition and nutritive value of forage. With progression the plant growth stages, the percentage of crude protein and the structural carbohydrates change (cellulose and lignin). As a result of this, the plant digestibility and preference value decrease. On the other hand, with the development of plant growth stages, the moisture and vigor of plants decrease [4]. Considering that, different plant species in various stages of growth do not have the same preference value, therefore by studying the preference value of forage plants, we can select more suitable plants which have less volatility in preference value at different stages of their growth and thus improve the potential use of rangelands.

According to Aregheore *et al.* [5] in a study on the grazing behavior of goats at the 3 regions in Cook Islands during the dry season period, attempted to elucidate that, there were some variations in the available plant species for grazing in the locations. Goats consumed *Commelina benghalensis* commonly called "water grass. *Commelina benghalensis* has high moisture and protein contents. They explain that: foliage cover, feeding time and preference value and selective grazing are influential on the quantity and quality of foliage ingested by goats. Except the crude protein, the other nutrients are similar to in the same forages in the three locations. Mirdavody and Sanadgol [6] used the timing method to determine the preference value of plant species in rangelands of Markazi province during the grazing months. They studied the affecting factors on preference value, including

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morphology, phenology and chemical characteristics of plant species. Comparison of timing method and the data gathered on the characteristics and quality of forage showed that the preference value of species such as *Bufonia.cf.kolzii*, *Dactylis glomerata*, *Bromus tomentellus* and annual grasses in the early of grazing season intensity were used by livestock. *Bufonia.cf.kolzii*, *Artimisia aucheri*, *Bromus tomentellus* and *Dactylis glomerata* were consumed 74, 43, 59 and 56 percent, by sheep, respectively.

Bromus tomentellus is a stable species with cold season grazing value and cluster biological form. This plant is one of the species representing the semi-steppe areas of Iran. This species is seen dominant in Albors and Zagros mountainous and central mountains of Iran. It is a palatable species which is consumed by all classes of livestock, particularly sheep. Heavy grazing prevents the flowering stage of this plant. Harvesting more than 70 percent causes the plant height and yield to decrease severely. The grazing period is short and generally from mid-spring to midsummer [7]. *Bromus tomentellus* has different ecotypes in Iran. Some morphological traits such as being fluff leaves, length of leaf and the rate of yield are highly various and so the preference value of *Bromus tomentellus* Boiss species has been studied in different growing stage and steppic areas.

MATERIALS AND METHODS

Study Areas: The study areas were located in four sites, which represented the semi-steppic region. The habitat characteristics of the study sites are given briefly in the table.

Mean annual precipitation (mm)	Altitude (m)	Location	province	site
600	3000-3400	46°20′E	AZARBAYEJAN	
		37°44′N	SHARGHI	SAHAND
400	2880	52°36′E,		
		35°52′N	TEHRAN	FIROZKOH
487	2250	21°48′E		
		36°45′N	ZANJAN	BADAMESTAN
302	2420	53°57′E		
		35°57′N	SEMNAN	JASHLOBAR

Methods: To evaluate the preference value of *Bromus tomentellus*, its forage production and consumption were studied in the sites which have variation rainfall in different months in years 2007 and 2008. The production was studied based on measuring the yield of confined quadrate and the consumption was studied based on calculating the quadrate which is grazed by livestock.

The forage production was calculated in growing season and the c onsumption in the grazing season.

Table 1: Palatability based on PI

row	Preference Index	Class of palatability
1	I>2.1	Highly Palatable
2	1.4-2	Very Palatable
3	0.7-1.3	Palatable
4	0.3-0.6	Non Palatable

Measurement the forage production of the species started annually in the confined plot from the early growing season with intervals of one month to the end. Also the consumption of the species in outside the quadrate was measured. Consequently, at the end of the grazing season, the remaining forage for each species was calculated and estimated the consumption by subtracting it from the production of the confined quadrate.

In sampling for measurement of the production and consumption, due to the problem of low coverage in most species and to avoid collecting too many samples, the average grades of each species were used. In each month at least five average grades in the quadrate and five average grades outside the quadrate for each species were selected.

By calculating the canopy cover and density of all species in the confined quadrate and then dividing the total coverage by total density, the average grade size of each species was determined.

The forage harvested in each month for each species and grade was placed in to the pouch and carried to the laboratory then was dried in open air and weighed afterward.

Dry forage weight was used as the criteria of the forage production and consumption assessment on site. With comparing the production of each species in different months, the trend of plant growing and the maximum production time was determined.

From the vegetation data, preference values were calculated for *Bromus tomentellus*. On the basis of the preference value, plant groups were ranked in palatability classes. [8-9]. preference value (PI) was calculated as:

$$pI=\frac{plant\ consumed}{plant available}$$

Prior to data analysis, all the data were tested with Shipro-Vilk for normal test. Finally, the data was analyses in a combined analysis randomized complete block design, in 2 years and 4 locations with SAS ver 9.1 software. Duncan Multiple Range Test at 5% Level for analysis and comparison of means.

Table 2: Variance Analysis of Preference Values between different months and Sites

Sources of variation	df	Mean Squares	F Value
Habitat	3	5.99764385	11.41*
Climate condition	1	0.73112460	96.11**
Climate condition* habitat	3	0.21672359	0.52 ns
Error1	32	0.19892624	-
Growth stage	3	0.08830646	0.24 ns
Growth stage * habitat	9	0.59457343	2.11 ns
Growth stages * climate condition	3	0.05546817	0.20 ns
Growth stages * climate condition *habitat	9	0.28228678	5.13**
Error1	91	0.05504681	-

• *P<0.05,**P<0.01,NS:Non-significant.

RESULTS

The results of variance analysis of *Bromus tomentellus* preference value in two years and during growing season in 4 habitats, is presented in table 2. Variance Analysis showed that the effect of growth stage on the preference value is insignificant. The results also indicated that the preference value in different habitats is statistically significant at level 5%. The effect of climate conditions and the interaction of the habitat * climatic conditions * growing stages are statistically significant at level 1%. Because the interaction was significant, it can be said that, the preference value was affected with habitat and climate conditions.

Variance analysis showed the preference value of *Bromus tomentellus* is statistically insignificant between growth stages. The Comparison of different months has been shown in figure 2. As is clear, the preference value of *Br. Tomentellus* increases from the start of the growth to maturity, but decreases in the drying stage. In general, the changes are not statistically significant

Variance analysis of preference value of *Br.tomentellus* between different habitats is statistically significant at five percent level.

As is clear in Figure 3, *Bromus tomentellus* has the highest preference values in the Sahand Site and the lowest in the Badamstan site

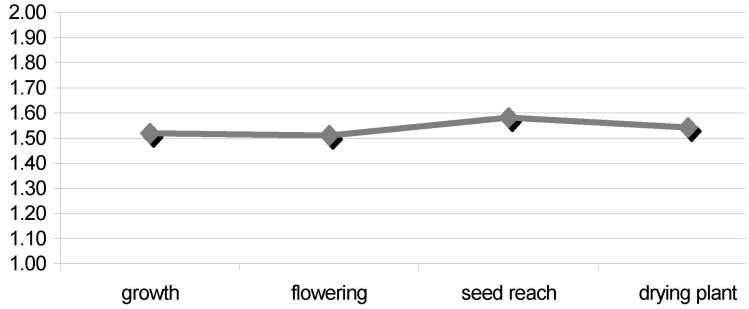

Fig. 2: Comparison of preference values of *Bromus tomentellus* at different stages of growth

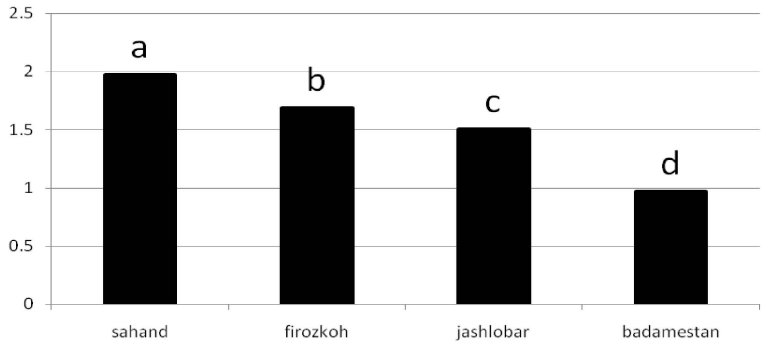

Fig. 3: Comparison of *Bromus tomentellus* preference values in different sites

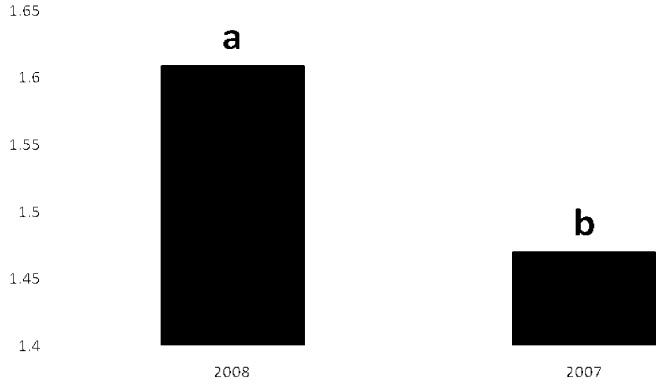

Fig. 4: Comparison of Average Preference Values in the Years of Study

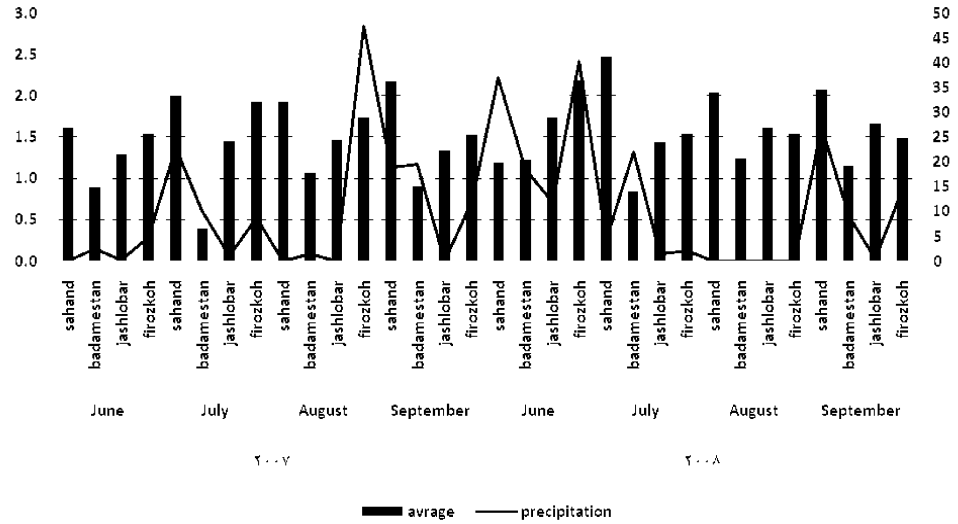

Fig. 5: Relationship between Rainfall and the Preference value in Years of study and the Various Sites

The results of variance analysis of preference value of *Br. Tomentellus* revealed that the preference value in the studied years was different and significant at level 1%. Variety of preference value in different years showed the effect of climate changes such as rainfall.

Figure 4 shows that the average of preference value of *Br. tomentellus* in 2008 is higher than 2007.the Average annual precipitation in investigated habitats in 2008 is higher than 2007. This rate is 649 mm for 2007 and 869 mm for 2008.

To investigate the correlation between rainfall and the preference values, the Pearson test was used. Figure 5 shows the relationship between rainfall and the preference values of Bromus tomentellus in years, various growth stages and different habitats.

As it is clear from Figure 5, there is no correlation between rainfall and Preference value of Bromus tomentellus. For example, the Sahand site has had the highest preference value in July 2008, but the rainfall is very low. While the Badamestan site, with the lowest preference value, has had higher rainfall than Sahand site in July. Pearson correlation between monthly rainfall and monthly preference value of Bromus tomentellus is about 0.13 which is indicative of their weak correlation.

Table 3 shows the annual rainfall from October to September (growth stage) in 2007 and 2008 in the study sits. The amount of rainfall in 2008 increased in all sites except the Firozkoh. The highest rainfall was in the Firozkoh in 2007 with the amount of 282.2mm and the lowest in Badamestan with the amount of 49.5mm. The highest and lowest rainfalls in 2008 were in Firozkoh and Jashlobar sites respectively. Table 4 shows the relationship between the preference values of Bromus tomentellus with seasonal rainfall. As is clear, there is no correlation between seasonal rainfall and the preference value. Despite of The highest correlation between winter precipitation and preference value of Bromus tomentellus is about 0.18 but is still statistically insignificant.

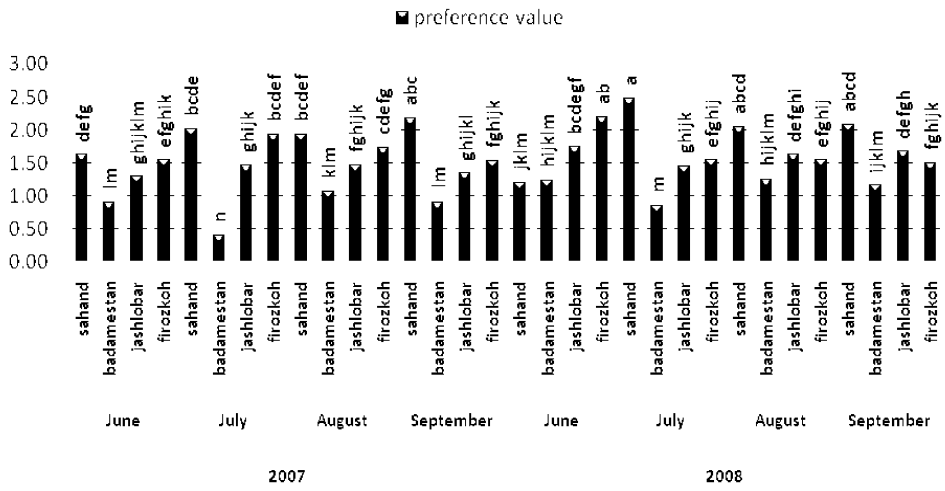

Fig. 6: Comparison of the preference values in different sites and years

Table 3: Annual rainfall from October TO September in 2007 and 2008 in the Study Sites

Year	Site	Annual Rainfall mm
2007	SAHAND	143.20
	BADAMESTAN	174.64
	JASHLOBAR	49.45
	FIROZKOH	282.21
2008	SAHAND	240.71
	BADAMESTAN	239.04
	JASHLOBAR	131.76
	FIROZKOH	252.88

Table 4: Correlation between the Preference Value and Precipitation

1	Annual preference value
-0.085	OCT TO September rainfall (in growth)
0.18	Winter precipitation
0.013	Spring Precipitation
-0.05	Fall and winter precipitation
-0.04	Summer precipitation

Figure 6 shows the preference value of *Br. tomentellus* at different stages of growth in different habitats in two years. The trend of the preference value from early growth to flowering stage is approximately stable and in some habitats significant. For example, in the Sahand site, despite the preference value of *Br. tomentellus* from early growth to flowering stage increased in 2007 and was not statistically significant, but it was significant in 2008. There were no preference value variations in the Badamstan site among growing stages except the seeding stage in which the prefence value decreases and becomes statistically significant. The highest preference value is in sahand site in July 2008 and the lowest is in the Badamstan site in July 2007.

The minimum preference value of *Bromus tomentellus* is in maturation stage. The preference value of *Bromus tomentellus* in Jashlobar site at different growth stages in 2007 and 2008 is statistically insignificant with a stable trend in the two years.

DISCUSSION

Due to variety chemical and morphological characteristics, plant species have different levels of preference value. Furthermore, environmental factors such as climate and seasonal changes are affecting a plant's preference value. A comparison *Bromus tomentellus* preference value in the four sites shows that the Sahand site has the highest and the Badamestan site has the lowest preference value.

Species composition, percentage volume and available forage are effective factors in changing the preference value of species [4-10]. Studying *Bromus tomentellus* canopy cover in sites shows that the Sahand site has the most canopy cover. It is nearly 9.2 percent of the total coverage. The Firozkoh site has nearly 3.5 percent and the Jashlobar site has 0.8 percent *Bromus tomentellus* of the total cover. The canopy cover can affect the volume of forage harvest and preference value. In Furthermore, the frequency of the associated species, the cover percentage and composition also affect preference value [11-12-13-14-15-5]. According to forage access is an affective factor in selecting plants by cattle.

The results show that the Sahand site has had the maximum preference value of *Bromus tomentellus* in July 2008 and the Badamstan site has had the minimum preference value in July 2007. Diagnosis the trend of

preference value of species in pasture, the adequate data and long-term evaluation is necessary. Rainfall, by itself, has little effect on changing the composition of vegetable crop canopy as well as plant preference value [16]. The results show, the preference value of *Br. tomentellus* increases until the maturation stage, but decreases in the drying stage. In general, these changes are statistically insignificant and the preference value of this species is constant throughout time [17] Investigated the preference value of plant species in Nadooshan of Yazd showed, there was no significant between the various stages.this result contradict with Reagain[18], Dwyer[19] and Ghodsi Rasei [20]. This can be due to post-graze regrowth of species. The regrowth species indicate a higher preference value despite the growing time and woody sprouts. Therefore, there is no preference value variation between different months.

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