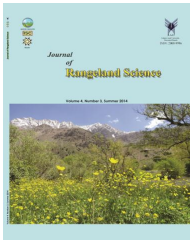
Contents available at ISC and SID

Journal homepage: www.rangeland.ir



Full Length Article:

Preference Value Evaluation of Rangeland Plant Species for Kaboudeh Sheep

Reza Erfanzadeh[A], Moharam Ashrafzadeh[B], Seyed Hamzeh Hosseini Kahnuj[C], Arezu Alizadeh[D]

[A]Assistant Professor, Department of Rangeland Management, Tarbiat Modares University, Tehran, Iran (Corresponding Author), Email: Rezaerfanzadeh@modares.ac.ir
[B,D]M.Sc. Student, Department of Rangeland Management, Tarbiat Modares University, Tehran, Iran
[C]Ph.D. Student, Department of Rangeland Management, Tehran University, Tehran, Iran

Received on: 08/02/2014
Accepted on: 12/05/2014

Abstract. Study on the livestock diet is one of the main priorities in the management of rangeland in Iran. So, this study was conducted to compare preference values of plant species in three age classes of Kaboudeh sheep (one, three and five year old ones) in rangelands of Bavanat, Fars province, Iran. For each age class, four sheep were selected and their grazing times from different plant species were recorded using a timing method (chronometer) for two hours during the day. The effects of livestock age, plant species and their interactions on preference values of plant species were assessed using a factorial experiment (GLM test). Also, one way ANOVA was applied to compare preference values between plant species for each age class of animals. The results showed that the age of the animals and plant species had significant effects on preference values of plant species. Species of *Poa pratensis* and *Avena fatua* for young animals and *Acer cinerascens* for older animals had higher preference values. In addition, species of *Poa pratensis* and *Prangos ferulaceae* had appropriate preference values for all three age classes of animals. As vegetation cover in the study area is mostly consisted of the bushes and shrubs in autumn and on the other hand, sheep has little ability to graze this kind of plant species subsequently during the grazing period, they dominantly focus on herbal species. In general, animal diet demands cannot be provided from rangelands and it is required to use the methods of manual feeding with dry forage and supplements. One of the possible alternatives is to harvest and store the annual yield of *P. ferulaceae* in spring in order to feed the animals in autumn and winter.

Key words: Preference value, Age class, Kaboudeh sheep, Bavanat rangelands

Introduction

Nutritional needs and grazing of livestock in rangelands are often encountered with problems such as low forage quality and quantity. Knowledge about the factors that affects the selection and preference of forage by livestock is necessary for proper management of rangelands, especially in arid and semi-arid regions. In addition, suitable rangeland management requires an adequate knowledge about temporal and spatial variations of forage quality, quantity and preference value of plant species for livestock as well. Preference value is defined as higher tendency of animals to graze a special plant species in comparison with other species in free grazing conditions in which animal is able to select plant species freely.

Preference value is affected by animal characteristics such as age, sex and kind of livestock (Arzani, 2009). Study on forage quality has been done continuously in Iran (e.g. Ghanbari and Sahraei, 2012) while the results about diet selection and preference values have been seldom reported (Askarizadeh and Heshmati, 2010). Recognition of livestock diet can be used to set proper programs of feeding for different kinds of animals in different seasons in order to reach a better management of rangelands. Some researchers such as Ashrafzadeh *et al.* (2012) studied plant species preference values for camels in southern region of Fars province. They reported that annual species (e.g. *Stipa capensis*) in spring and perennial species (e.g. *Ziziphus spina-christi*) in other seasons can be efficiently used for supplying nutritional demands of camels. Hosseini Kahnuj *et al.* (2011) studied preference value of plant species for Raeeni goats in rangelands of Kahnuj in South of Kerman province.

They reported that in conditions of abundance of forage supply during the late winter to the late spring, grass species (e.g. *Stipa capensis*) and in the late summer, shrubby plants have important roles in supplying diet for this animal. Baghestani Meybodi and Arzani, (2004) evaluated preference values of some important plant species in steppe rangelands of Yazd and reported that in existence of grass species, animals focus on grazing these species but if these grass species decrease, animals divert their preference to shrubs. Dianati Tilaki & Mir Jalili (2007) investigated the times that different animals (sheep and goat) spent on grazing some plant species in Yazd rangelands. They stated that some species (e.g. *Artemisia aucheri*) were the most palatable plants for sheep. Haenlein & Ramirez (2007) reported that sheep preferred to graze grasses, shrubby plants and forbs, respectively. On the other hand, individuals of a kind of animal also differ in their grazing behavior. Vallentine (2001) and some other researchers (e.g., Ahmadi *et al.*, 2009 and Arzani, 2009) considered the animal's age as one of the most important factor that affects the diet preference of livestock. However, there are many different factors that affect diet of livestock in rangelands. As a result, it is necessary to conduct the studies in different conditions such as different regions in the country, different seasons and different kinds of livestock to identify factors that affect grazing behavior of livestock. Finally, as there should obtain knowledge about animals and pastures in each region instead of approving one program for all rangelands, special programs can be prescribed for each rangeland. So, this study aimed to assess preference values of plant species for three age classes (one year, three years and five year old ones) of Kaboudeh sheep race in summer rangeland of Bavanat, Fars province, Iran.

Materials and methods

Study area

The study area is located in the rangelands of northeastern Bavanat, Fars, Iran. The distance of the study area from

Shiraz city was 240 km and its area was ca 700 ha. Mean annual rainfall of the area is 270 mm that falls mostly during autumn and winter seasons. Geographical location of the study area is 53° 45' 43" eastern longitude and 30° 12' 14" northern latitude. Regional climate is cold and dry winters and summers' duration is short with mild temperature. Minimum and maximum air temperatures are -20 °C and 34 °C, respectively. Maximum altitude is 3362 m above sea level at peak of mount Khaton (Ashrafzadeh *et al.*, 2014). Vegetation cover includes herbaceous species, bushes, shrubs and trees. In spring, annual plants such as *Prangos ferulaceae* have a considerable persistence in vegetation cover of the study area.

Vegetation cover measurements

Vegetation sampling was done in the mid of autumn, at the period of falling down of leaves of shrubs and trees (and after seeding stage of perennial herbs). Although, bushes and shrubs were dominated in the above-ground vegetation, herbaceous species in form of dry stands existed in composition of vegetation as well. 3×3m plots were applied in the study for vegetation assessment (Kerbs, 2001; Mesdaghi, 2002; Cox, 2002). In the study area, three key areas were selected. In order to evaluate vegetation cover, 20 plots were established randomly in each key area. Then, percentage of cover of all plant species was estimated and plant species were also identified inside the plots.

Measurement of preference values of plant species

Preference values of all plant species were recorded by a timing method (chronometer) for three age classes of animals in the key areas. Three age classes of Kaboudeh sheep (ewes of one, three and five year old ones) were selected. Then, for each age class, four focal animals were selected. In each day, one focal animal grazing duration of plant species was measured for two hours. Time recording was done every morning from 8 to 10 AM. Then, relative grazing time of each species was determined in a percentage value. As different species had different preference values, plant species were also classified into the palatability classes. In the first step, the time that was spent on grazing a special species was recorded by a timing method (Chronometer), then preference value was computed (relative grazing time) and analyzed with the software. Finally, according to the preference values of plant species in the experimental field, the class of palatability was defined for each plant species.

Statistical analysis

The data had a normal distribution. Factorial experiment (GLM: General Linear Model) was used to examine the impacts of animal age, plant species and their interactions on the preference values. The preference value as the dependent factor and age and species as the fixed independent factors were entered into the model. Since the interactions between age and plant species were not significant, one-way ANOVA and post-hoc tests were used to compare the preference values of plant species for each age class of animals (one, three and five year old ones). All statistical analyses were applied by Excel and SPSS ver. 17 software.

Results

Vegetation types in the experimental field

Based on the field surveys and dominant plant species, three vegetation types (communities) were recognized in the study area. It should be noted that some of the recorded species were in the form of dry standing vegetation and litter (Table 1).

Table 1. Plant species that existed in each vegetation type

	Species	Family	Life Form	Vegetation Cover (%)
Type I	*Ferula foetida*	Apiaceae	Herb	33
	Artemisia aucheri	Asteraceae	Shrub	17
	Prangos ferulaceae	Apiaceae	Herb	13
	Acer cinerascens	Aceraceae	Tree	8
	Amygdalus lycioides var. *horrida*	Rosaceae	Shrub	3
Type II	*Artemisia aucheri*	Asteraceae	Shrub	40
	Prangos ferulaceae	Apiaceae	Herb	10
	Avena fatua	Poaceae	Herb	15
	Poa pratensis	Poaceae	Herb	10
	Berberis vulgaris	Berberidaceae	Shrub	3
	Phlomis fruticosa	Lamiaceae	Herb	2
Type III	*Acer cinerascens*	Aceraceae	Tree	25
	Amygdalus lycioides var. *horrida*	Rosaceae	Shrub	18
	Ferula foetida	Apiaceae	Herb	10
	Prangos ferulaceae	Apiaceae	Herb	8
	Artemisia aucheri	Asteraceae	Shrub	3
	Gundelia tournefortii	Asteraceae	Herb	1
	Achillea millefolium	Asteraceae	Herb	1

Analysis of variance and mean comparisons

Results of GLM showed that preference values of plant species were significantly affected by animals' age classes and plant species. But animal age and plant species interaction effects were not significant on preference value of plants by Kaboudeh sheep (Table 2).

Results of one way ANOVA and Duncan test showed that plant species had a significant difference of preference values for Kaboudeh sheep. *Poa pratensis* and *Avena fatua* had the highest preference value for one year old animals and species such as *Astragalus parrawinus* and *Acer cinerascens* were not grazed by this age class. Three-year-old animals spent most of their time on grazing *Prangos ferulaceae* and *Poa pratensis* but they did not grazed *Amygdalus lycioides* var. *horrida.*

The highest preference value of the *Acer cinerascens* and *Poa pratensis* was related to five year old animals, and species such as *Berberis vulgaris* were not consumed by the animals of this age (Table 3). Finally, the results showed that the palatability of *Prangos ferulaceae* was in class I for all the ages (Table 4).

Table 2. The result of the analysis of variance and the level of F significant of animal age, plant species and their interactions on the preference value

Sources of Variations	df	F	Sig.
Animal age	2	1.36	0.043
Plant species	15	4.22	0.000
Plant species× Animal age	30	1.32	0.512

Table 3. Comparison of preference values of plant species for each age class by one-way ANOVA

Plant Species Name	Family	Life Form	Animal Age Class		
			One Year Old	Three Years Old	Five Years Old
Artemisia aucheri	Asteraceae	Shrub	3.60 C (a)	4.70 C (a)	8.30 C (a)
Acer cinerascens	Aceraceae	Tree	0.00 D (c)	0.00 D (c)	4.51 A (a)
Avena fatua	Poaceae	Herb	14.10 B (a)	14.00 B (a)	3.70 C (b)
Amygdalus lycioides var. *horrida*	Rosaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
Astragalus adscendens	Fabaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
Achillea millefolium	Asteraceae	Herb	9.00 C (a)	0.00 D (c)	0.00 D (c)
Astragalus parrawinus	Fabaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
Berberis vulgaris	Berberidaceae	Shrub	0.00 D (c)	0.00 D (c)	0.00 D (c)
Ferula foetida	Apiaceae	Herb	0.00 D (c)	0.00 D (c)	0.00 D (c)
Gundelia tournefortii	Asteraceae	Herb	0.00 D (c)	0.00 D (c)	3.80 C (a)
Malva neglecta	Malvaceae	Herb	0.00 D (c)	0.00 D (c)	0.00 D (c)
Melilotus officinalis	Fabaceae	Herb	0.00 D (c)	1.40 C (a)	0.00 D (c)
Phlomis fruticosa	Lamiaceae	Herb	0.00 D (c)	0.00 D (c)	0.00 D (c)
Poa pratensis	Poaceae	Herb	44.10 A (a)	33.1 A (a)	49.60 A (a)
Prangos ferulaceae	Apiaceae	Herb	6.50 C (b)	16.5 B (a)	17.40 B (a)
Scorzonera tortuosissima	Asteraceae	Herb	0.00 D (c)	0.00 D (c)	5.50 C (a)

Capital letters show comparisons of column (between species for individual animal's age class)
Lowercase letters in parenthesis show comparisons of row (between age classes of animals)
(As the numbers in the table were too small so each number was multiplied by 100)

Table 4. Class of palatability of plant species for three age classes of sheep

Plant Species	Family	Life Form	Palatability Classes for Age Classes of Animals		
			One Year Old	Three Years Old	Five Years Old
Artemisia aucheri	Asteraceae	Shrub	III	III	III
Acer cinerascens	Aceraceae	Tree	N	N	I
Avena fatua	Poaceae	Herb	II	II	III
Amygdalus lycioides var. *horrida*	Rosaceae	Shrub	N	N	N
Astragalus adscendens	Fabaceae	Shrub	N	N	N
Achillea millefolium	Asteraceae	Herb	III	N	N
Astragalus parrawinus	Fabaceae	Shrub	N	N	N
Berberis vulgaris	Berberidaceae	Shrub	N	N	N
Ferula foetida	Apiaceae	Herb	N	N	N
Gundelia tournefortii	Asteraceae	Herb	N	N	III
Malva neglecta	Malvaceae	Herb	N	N	N
Melilotus officinalis	Fabaceae	Herb	N	III	N
Phlomis fruticosa	Lamiaceae	Herb	N	N	N
Poa pratensis	Poaceae	Herb	I	I	I
Prangos ferulaceae	Apiaceae	Herb	III	II	II
Scorzonera tortuosissima	Asteraceae	Herb	N	N	III

N= Not grazed by sheep

Discussion

According to the results of this study, different plant species have different preference values for Kaboudeh sheep. Although most of the nutritional requirements of the livestock in the studied area were supplied from the rangelands, our results indicated that vegetation composition in autumn is poor. Dominant plants in the area are in the shrubby and bushy forms in autumn while sheep has little ability to graze such plants. Some other researchers identified that grazing season is an effective factor on preference value of plant species (Sanadgol, 2005; Alikhah Asl *et al.*, 2009; Schwartz and Ellis, 1981; Migongo-Bake and Hansen, 1987). Raoufi Rad *et al.* (2013) reported that bushy species had less palatability for sheep and a greater part of its diet (about 67%) is consisted of herbaceous species. However, our results showed that the age classes differ in their grazing behaviors in

consuming plant species. One-year old animals consumed only five of the 16 different plant species in the area. *Poa pratensis* and *Avena fatua* had higher preference values for one-year sheep and shrubby species except *Artemisia aucheri* was not consumed by these animals. In addition, *Artemisia aucheri* had not considerable preference values and is classified in class III of palatability. Therefore, it can be concluded that in extreme environmental conditions that herbaceous species are rare in the plant composition, one-year old sheep do not have any tendency to consume bushy and shrubby species and subsequently, they are not able to provide their nutritional requirements by grazing the branches. Hosseini Kahnuj *et al.* (2011) showed that one-year old animals spent most of their time on grazing of herbaceous species. On the other hand, consumption of bushy and shrubby species by this age class was minimal. Indeed, bushy and shrubby species have harsh and unfavorable structures. But older animals (three years and older) had focused to consume species such as *Prangos ferulaceae* and *Poa pratensis* while these age classes did not graze such species as *Amygdalus lycioides* var. *horrida.*

Despite other ages, five-year old animals grazed *Acer cinerascens* strongly and this tree was in the group of palatable species for five-year old animals. This age group consumed *Gundelia tournefortii* occasionally although their tissue was barbed. The results reported by Ashrafzadeh *et al.* (2012) showed that older animals are more successful to select tree species and woody plants can provide a part of their nutritional requirements. Hosseini Kahnuj *et al.* (2011) stated that older animals had wider thresholds to select a composition of herbaceous, bushy and shrubby species for grazing. These results showed that sheep did not graze branches in considerable amount but in hard conditions, the animals that had good physical conditions were able to provide a part of their nutritional requirements from species such as *Gundelia tournefortii* and *Acer cinerascens*. Forage availability can affect both consumption and nutritional values of grazed forage (Rogosic *et al.,* 2006; Yayneshet *et al.*, 2008) and older animals are taller and prefer to graze tall species (Sanon *et al.*, 2007).

Conclusion

In overall, the results of this study showed that in every composition of plants, the sheep prefer to graze herbaceous species and their ability for grazing woody species was very little. Therefore, sheep in hard conditions (i.e. autumn) were not able to supply the requirements from rangeland and it is necessary to feed them with complementary forage. One of the options can be the harvesting of some plants (e.g. *Prangos ferulaceae*) and storing of them in spring to feed animals in autumn and winter.

Literature Cited

Ahmadi, A., Sanadgol, A. A., Mohseni Saravi M., Arzani, H. and Zahedi Amiri, GH., 2009. Investigation of behavior and diet selection of different ages of Zandi sheep. *Rangeland,* 3(2): 232-245. (In Persian).

Alikhah Asl, M., Azarnivand, H., Arzani, H., Jaafari, M. and Zare Chahoki, M. A., 2009. Palatability relationship with the weight ratio of leaves and stems at different phonological stages. *Rangeland,* 3(2): 246-258. (In Persian).

Arzani, H., 2009. Forage quality. Tehran University Press. Tehran. 354pp. (In Persian).

Ashrafzadeh, M., Erfanzadeh R. and Hosseini Kahnuj, S. H., 2012. Effect of plant phonological stages on preference value of Baluchi camel in Zarrin Dasht rangeland. *Rangeland,* 6(1): 18-25. (In Persian)

Ashrafzadeh, M., Hossaini Kahnuj, S. H. and Azarnivand, H., 2014. Studying of livestock diet goats of Mamasani breed in summer rangelands of Bavanat city. Rangeland, in press. (In Persian).

Askarizadeh, D. and Heshmati, Gh. A., 2010. Diet selection by sheep and goats on upland

rangelands (North Alborz), (Case study: Javaherdeh rangeland of Ramsar). *Jour. Rangeland Science*, 1: 285-293. (In Persian).

Baghestani Meybodi, N. and Arzani, H., 2004. Palatability of the species range, and why the behavior of goats in the rangelands of Yazd. *Natural Resource*, 58(4): 909-919. (In Persian).

Cox, G. W., 2002. General ecology: laboratory manual. McGraw-Hill pub. USA.

Dianati, Tilaki, Gh. and Mir Jalili, A., 2007. Investigation on palatability of rangeland plants in Yazd region. *Pajouhesh & Sazandegi*, 76: 69-73. (In Persian).

Ghanbari, A. and Sahraei, M., 2012. Determination of nutritional value in three forage species in three phonological stages in Sabalan rangelands, Ardebil, Iran. *Jour. Rangeland Science*, 2: 449-457. (In Persian).

Haenlein, G. F. W. and Ramirez, R. G., 2007. Potential mineral deficiencies on arid rangelands for small ruminants with special reference to Mexico, *Small Ruminant Research*, 68(1): 35-41.

Hosseini Kahnuj, S. H., Erfanzadeh, R. and Kamali, P., 2011. Evaluation of preference value and forage protein variations of plant species in Kahnuj rangelands of Kerman province. *Pajohesh & Sazandagi*, 91: 58-67. (In Persian).

Kerbs, C. J., 2001. Ecology: the experimental analysis of distribution and abundance. Fifth ed. Addison Wesley Longman, Melo Park, California, USA.

Mesdaghi, M., 2002. Plant ecology. Mashhad University Press.187pp. (In Persian).

Migongo-Bake, W. and Hansen, R. M., 1987. Seasonal diets of camels, cattle, sheep, and goats in a common range in Eastern Africa, *Range Management*, 40: 76-79.

Raoufi Rad, V., Ebrahimi, A., Arzani, H. and Shojaie Asadiyeh, Z., 2013. Investigation on relationship between palatability and forage quality in some of rangeland plants (Case study: Karsanak rangelands of Chaharmahal and Bakhtiari province). *Range and Watershed Management*, 66(1): 111-120. (In Persian).

Rogosica, J., Pfisterb, J. A., Provenzac, F. D. and Grbesad, D., 2006. Sheep and goat preference for and nutritional value of Mediterranean maquis shrubs, *Small Ruminant Research*, 64: 169-179.

Sanadgol, A. A., 2005. Vegetative and productive characteristics of plants and livestock grazing in the pastures Saveh Rode Shor. Proceedings of Conference on Rangeland management in arid areas of forests and rangelands, 48-34. (In Persian).

Sanon, H. O., Kabore-Zoungrana, C. and Ledin, I., 2007. Behavior of goats, sheep and cattle and their selection of browse species on natural pasture in a Sahelian area, *Small Ruminant Research*, 67(1): 64-74.

Schwartz, C. C. and Ellis, J. E., 1981. Feeding ecology and niche separation in some native and domestic ungulates on the short grass prairie, *Applied Ecology*, 18: 343-353.

Vallentine, J. F., 2001. Grazing management. 2ed Edition, Academic Press, San Diego.

Yaynesheta, T., Eika, L. O. and Moec, S. R., 2008. Influences of fallow age and season on the foraging behavior and diet selection pattern of goats (*Capra hircus* L.), *Small Ruminant Research*, 77: 25-37.

ارزیابی ارزش رجحانی گونه‌های گیاهی برای گوسفند نژاد کبوده

رضا عرفان زاده[الف]، محرم اشرف زاده[ب]، سید حمزه حسینی کهنوج[ج]، آرزو علیزاده[د]

[الف] استادیار گروه مرتعداری، دانشگاه تربیت مدرس (نگارنده مسئول)، پست الکترونیک: Rezaerfanzadeh@modares.ac.ir
[ب، د] دانشجوی کارشناسی ارشد مرتعداری دانشگاه تربیت مدرس
[ج] دانشجوی دکتری مرتعداری دانشگاه تهران

چکیده. مطالعه‌ی رژیم غذایی دام‌ها یکی از مهمترین اولویت‌های مدیریت مراتع کشور می‌باشد. تحقیق حاضر با هدف مقایسه‌ی ارزش رجحانی گونه‌های گیاهی برای سه گروه سنی (یک‌ساله، سه‌ساله و پنج ساله) گوسفند نژاد کبوده در مراتع شمال استان فارس (بخش مزایجان از توابع شهرستان بوانات) انجام شد. برای هر کلاسه سنی، چهار رأس دام انتخاب و به مدت دو ساعت در هر روز، زمان چرای هر رأس دام از گونه‌های گیاهی بوسیله‌ی روش زمان‌سنجی (کورنومتر) اندازه‌گیری شد. برای بررسی اثر سن دام، گونه گیاهی و اثر متقابل آنها بر روی ارزش رجحانی گونه‌ها از طرح فاکتوریل (آزمون GLM) استفاده شد. مقایسه ارزش رجحانی گونه‌های گیاهی برای هر کلاسه سنی دام با استفاده از آزمون تجزیه واریانس یکطرفه انجام شد. نتایج نشان داد کلاسه سنی دام و گونه گیاهی تأثیر معنی‌داری بر ارزش رجحانی گونه‌های گیاهی داشتند، بطوری‌که گونه‌های ***Poa pratensis*** و ***Avena fatua*** برای دام‌های جوانتر و گونه‌ی ***Acer cinerascens*** برای دام‌های مسن‌تر بیشترین ارزش رجحانی را داشتند. علاوه بر این گونه‌های ***Poa pratensis*** و ***Prangos ferulaceae*** برای هر سه گروه سنی ارزش رجحانی مناسبی داشتند. بطورکلی با توجه به اینکه اغلب پوشش گیاهی مراتع این منطقه در فصل پاییز مربوط به گونه‌های بوته‌ای و درختچه‌ای می‌باشد و از طرفی گوسفند توانایی چندانی در استفاده از چنین گونه‌هایی نداشته و غالب رفتار چرایی آن به گونه‌های علفی معطوف می‌باشد، بنابراین نیازهای غذایی دام در این شرایط نمی‌تواند از مراتع تأمین گردد و نیازمند اقدامات دیگری از جمله تغذیه دستی و کمکی می‌باشد. یکی از این گزینه‌ها می‌تواند برداشت و ذخیره بخشی از گونه‌ی ***P. ferulaceae*** در فصل بهار برای تغذیه دام در فصل‌های پاییز و زمستان باشد.

کلمات کلیدی: ارزش رجحانی، کلاسه سنی، گوسفند کبوده، مراتع بوانات