

Investigation of sheep diet and vegetation variations in mountainous rangeland (case study: Pastures of Baladeh-Noor Mazandaran province)

I. Haghiyan^{1*}, G.H. Heshmati², H. Barani³, G.H. Heydari⁴, J. Ghorbani⁴

1- PhD student of rangeland sciences in Gorgan University of Agriculture Sciences and Natural Resources, Shahid Beheshti St., Gorgan, Iran. Zipcode: 4913815749.

2- Professor, and 3- Associated Professor , Gorgan University of Agriculture Sciences and Natural Resources, Shahid Beheshti St., Gorgan, Iran. Zipcode: 4913815749.

4- Assistant Professor Sari University of Agriculture Sciences and Natural Resources, Farah abad St., Sari, Iran. Zipcode: 4817749565.

*Corresponding author Tel: +989113512086 , Fax: +981513119322, Email: haghiyan24@gmail.com

Journal of Livestock Science (ISSN online 2277-6214) 4: 97-103

Received on 1.07.2013 Accepted on 15.07.2013

Abstract

For proper grazing management and improvement of husbandry system efficiency, it is necessary to have enough knowledge of sheep diet and plant species cover variations in long-term period. This investigation was carried out in order to draw a clear concept of the sheep diet and plant species cover variations during April to December in Mountainous rangelands of Baladeh, Mazandaran province, Iran. Using an initial study, the region husbandry situations were determined that lead to identification of three pastoralists with suitable pastoral units. Based on initial study and plants growth season, sampling was conducted in 15-day time point to end of the grazing year in December. The chronic technique was used to determine the percentage of plant species in sheep daily diet. The result of Pearson correlation test showed that the species cover and the species contribution to the sheep diet are related ($r= 0.828$, $P<0.01$). *Bromus tomentellus*, *Astragalus sp* and *Artemisia aucheri* have the highest covers and contribution to the sheep diet in each area. From April to September, *Bromus tomentellus* had more than 30% the sheep diet but it reduced to less than 12% in the September to December period. *Astragalus sp* almost had constant proportion of the sheep diet (25- 35%). *Artemisia aucheri* had little contribution to the sheep diet in April to September period even decreased to zero in July, but had more than 30% of the sheep diet in the September to December period. Finally the results showed that during April to September period, sheep had higher interest to grasses but in the September to December period, Sheep had higher interest to shrubs. Also the forbs had constituted little proportion of the sheep diet (5-10%) during April to December.

Keywords: Husbandry system; sheep feed; plant species; Mountainous rangelands; Iran.

Introduction

Vegetation as a biotic and vital element hosts another biotic element in rangelands called grazing animals and management of both of these elements is in the man's hands. Thus knowing the status of both, the optimal management can be developed. Animal diet is directly influenced by vegetation and animals also strongly affect vegetation that with its understanding, the better rangeland management principles can be attained. Of environmental factors that affect the animal's diet, climate and rangeland condition are important. Climatic conditions have undeniable effects on the diet of livestock (Askarizadeh et al 2010). Schwartz & Ellis (1981) stated that the season is an influencing factor on the livestock diet and grazing. Van Niekerk & Abubeker (2009) also stated that Rangeland condition and vegetation composition are affecting the animals diet and various kinds of livestock. Arzani (2009) has stated energy efficiency of different livestock depends on the type of vegetation in the animal's diet. Actually plant species determine the efficiency of husbandry and play an important role in animal production. So it can be said that the composition, diversity and palatability of different plant species vary throughout the year, and the taste of animals has also short-term and long-term changes. Therefore patterns of vegetation and animal taste variation affect spatial and temporal pattern of grazing and it is necessary to examine them during investigation of the grazing episodes (Butt, 2010). Many studies have been done on the livestock diet and vegetation conditions- Van rees (1982) stated about seasonal changes of animal taste that plant phenological changes and climatic conditions affect the livestock taste and can cause changes in the livestock diet. He assessed cattle during the 4 months of summer and autumn in southern Australia and found a dramatic and significant change in their diet. Orr and colleagues (1988) investigated the importance of diet in improving meat and wool production in Queensland. By assessing two habitats of desired plant species of native deer, they concluded that despite similarity of vegetation percentage, there was a significant difference between two habitats in weight gain and wool production. Beck & Peek (2005) showed that sheep prefer forbs in spring and summer whereas goats willingly prefer shrubs in all seasons. In free and natural conditions, sheep prefer open environment than goats and these open and without stress environments play an important role in the milk composition richness and protein. Rueda and colleagues (2008) studied sheep grazing behavior in central Spain rangelands. They concluded that spatial pattern of sheep grazing during different seasons is affected by the forage availability. Raoufi-Rad et al (2009) has examined the relationship between the animal combination and vegetation composition for optimal management of rangeland. The results showed there is no relationship between percentage of species in sheep diet and percentage of species in the rangeland in terms of production and canopy cover and species grazing by sheep is generally driven by the choice. Ahmadi et al (2009) had examined sheep grazing behavior and diet habits in autumn and winter using chronic technique. The results of grazing cycle and behavior showed that there are no obvious and significant differences between ewes 1, 3 and 5 years in selecting plant species. Askarizadeh et al (2010) investigated sheep and goat diet in various time intervals (July, August and September, in different climatic condition and vegetation). The results of their study showed that goat grazing behavior was stable during the study period but sheep behavior changed based on vegetation changes; sheep was interested in forbs in August; in July, by dominating grass cover, sheep turned to grazing grasses; in September with approximately equal composition of forbs and grasses, sheep back turned to forbs. These studies indicate that achieving to a complete understanding of animal diet has an important role in determining the effectiveness and efficiency of husbandry system. As long-term study of animal diet is neglected in most cases, a study was done to assess animal diet in long-term with regarding vegetation composition changes.

Materials and methods

Study area

Baladeh region that is one of the main part of Noor county, is located in the Mazandaran province and the North mountainous highlands of Alborz in Iran. This area is part of the Central Alborz that is located in the north of Damavand Peak and between the Haraz and Chaloos roads. The area approximately covers 130000 hectares, which is located between 51° 26' - 52° 13' east longitude and 36° 10' - 36° 15' north latitude. The elevation of the region ranges from 1080 to 3300 m above sea level. Mean annual precipitation is 450 to 550 mm. Area of Balade rangeland is approximately 92,000 ha that encompasses roughly 11 percent of the province rangelands (Heydari et al, 2009). Sheep breeds in the district are Zell and Sangsari that are light and low feed and due to their low weight and long legs can roam for long time in heights.

Methods

Due to the extensive rangelands, an initial study was conducted to fully understand the region situation. Based on this initial study, three pastoral were identified that are in the region annually and their pastoral units/area were 200 to 400 ha (the mean area of region pastoral units is about 250 to 450 ha) and the pastorals own between 200 to 400 head of livestock. These three pastorals dwelled in three villages: Davilat, Chell, and Baladeh with separated spring, summer and fall pastoral units. Sampling of all three pastoral units, due to the presence of livestock in rangelands has started from the first half of April and continued until the first half of December. During the sampling, dominant growth forms, vegetation composition and animal forage preference were recorded in 15-day intervals. To determine the animal forage preference, the chronic technique was used, so that while animal was grazing, feeding time on each plant species was records. This was daily done during the 270 days of livestock presence in the rangeland. To show the time variation of livestock grazing on one species, the time of animal grazing on each species was calculated in terms of min/day with the total grazing time. By dividing one species grazing time on the total grazing duration, contribution of each species to the animal diet will be determined. Based on some studies (Barani et al 2003; Askerizadeh 2010), the adult ewes that compose the main part of the herd during the year, were selected as animal samples. Due to the inherent behavior of sheep, to monitor the animal activities, random selection of animal creates a smaller bias to data (Askarizadeh 2010). To carry out the monitoring, by standing in the appropriate distance from the herd so that the normal activity of herd is not disturbed, One animal (adult ewe) in the vision range was examined and upon its removal from perspective, another ewe in perspective was monitored.

Results

Assessing vegetation and sheep diet in all 3 regions showed that there were substantial changes in vegetation and plant species contribution to sheep diet during the nine months.

Pearson correlation test showed, generally there is a significant relation between percentage of species cover and its contribution to the sheep diet ($r= 0.828$, $P<0.01$) but each species has different trend in animal diet during the nine months period. *Bromus tomentellus*, *Astragalus sp* and *Artemisia aucheri* had the highest cover percentage and contribution to the sheep diet in all three regions. *Bromus tomentellus* had a share of over 30% in the diet of sheep from April to September but its contribution to the diet decreased to less than 12 percent in the period September to December. The cover percentage of *Astragalus sp* has not changed over the 9 months period and its contribution to the diet was almost constant (25 to 35 percent). The cover percentage of *Artemisia aucheri* has not changed over the 9 months period and had little contribution to the sheep diet in the period April to September that reached to zero in July but the species had a share over 30 percent in animal diet in the period September to December. *Festuca ovina* and *Agropyrum tauri* have participated in all three regions and included 5 to 10% of the vegetation cover. These two species that are the grasses, had contributed 10 to 15 percent to the sheep diet in the period April to September but their contribution reduced to less 10 percent in the period September to December and even reached to less than 5 percent in December (Fig1 to 6).

Vegetative forms in sheep diet

The results of the study in all three regions showed that though shrub cover was more than grasses during the period April to September, sheep is more interested in grass in the period April to September, so grasses had a greater proportion of the sheep diet (Fig 7 to 12). With reduction in grasses quality and quantity in the period September to December, sheep taste changed to shrubs. Forbs with regards to their coverage and its trifle variation, had almost included a constant proportion of the sheep diet (5 to 10%).

Long term (9-months) assessment showed that proportion of grasses, shrubs, and forbs had respectively contributed 45-50, 40-45, and 5-10 percent in the sheep diet, meanwhile, their cover percentage were 30- 35, 40- 45, and 5 respectively (Fig 13).

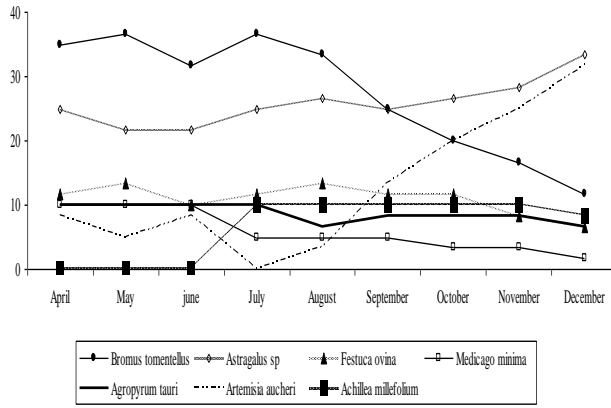


Fig 1- Davilat- Percentage of dominant species in sheep diet

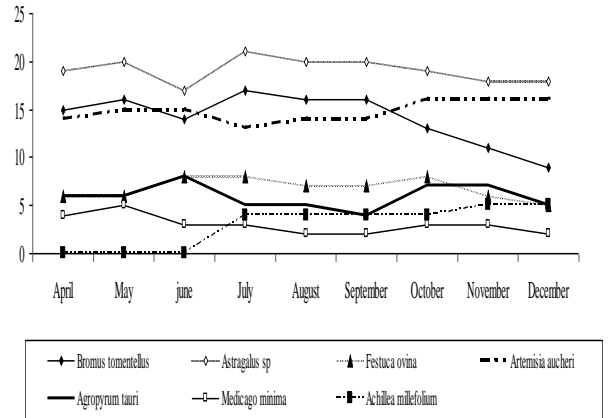


Fig 2-Davilat- Cover percent of dominant species

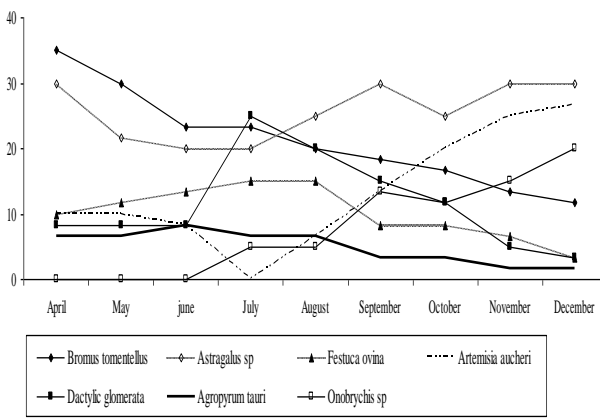


Fig 3-Chell - Percentage of dominant species in sheep diet

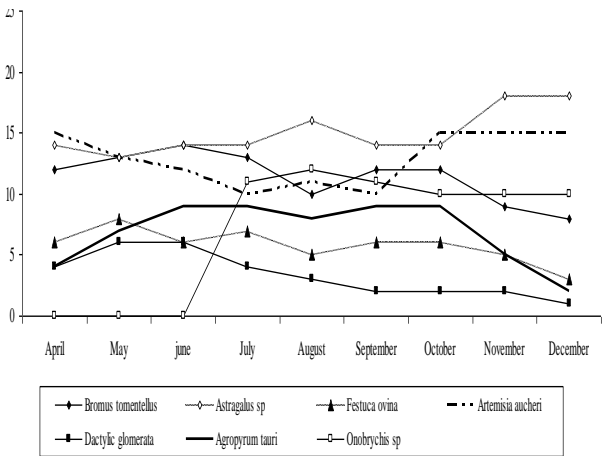


Fig 4-Chell- Cover percent of dominant species

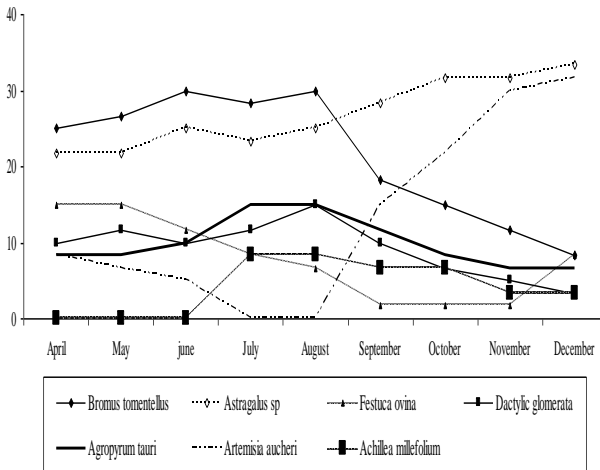


Fig 5- Baladeh - Percentage of dominant species in sheep diet

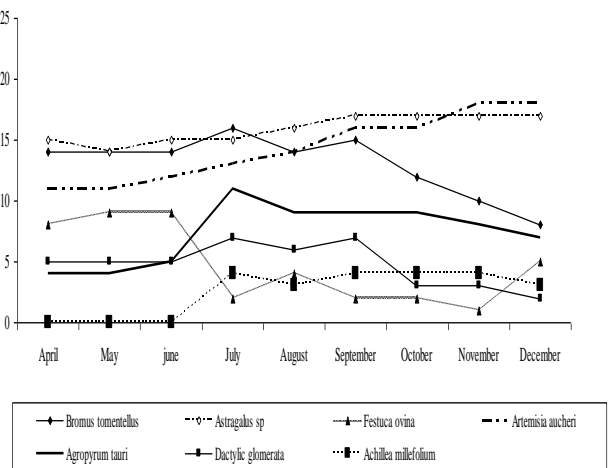


Fig 6-Baladeh- Cover percent of dominant species

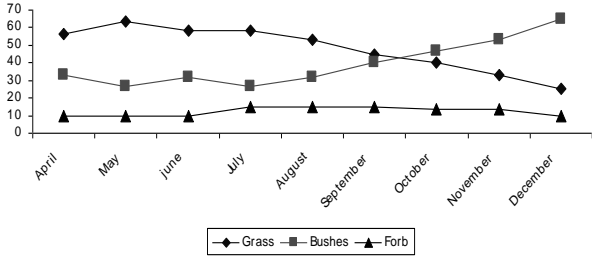


Fig 7-Davilat-Percentage of Vegetative forms in sheep diet

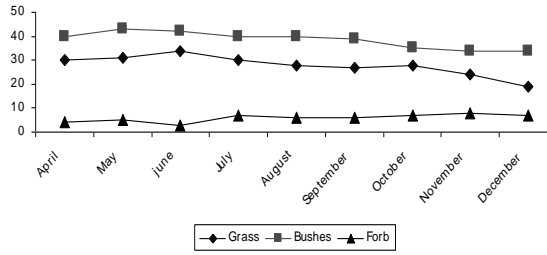


Fig 8-Davilat- Cover percent of Vegetative

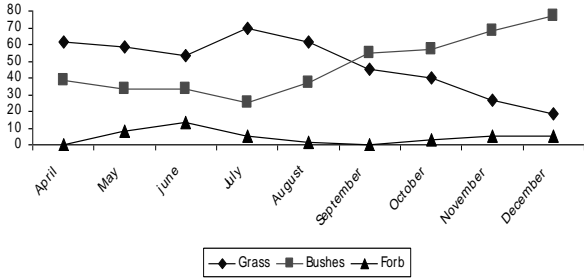


Fig 9-Chell-Percentage of Vegetative forms in sheep diet

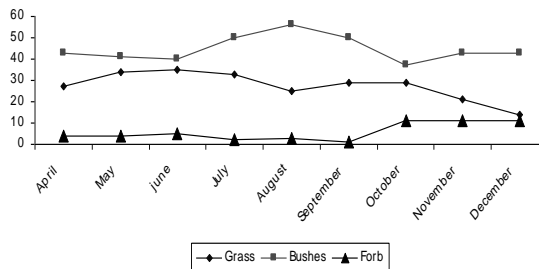


Fig 10-Chell- Cover percent of Vegetative

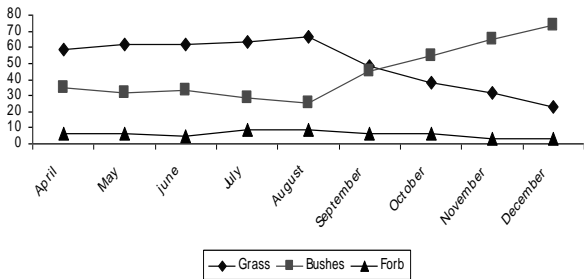


Fig 11-Baladeh-Percentage of Vegetative forms in sheep diet

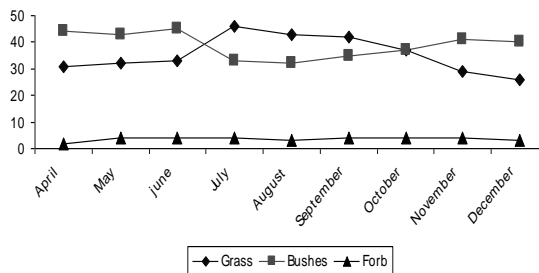


Fig 12- Baladeh - Cover percent of Vegetative forms

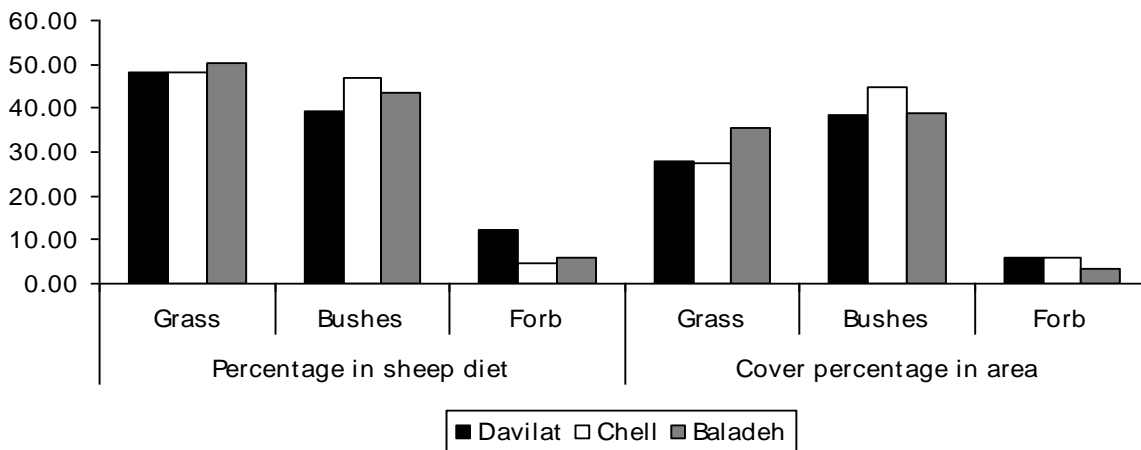


Fig 13- Average of Vegetative forms Percentage in sheep diet & Cover percentage in 9 month period

Discussion and conclusions

Assessing vegetation and animal diet in all three regions showed that there were substantial changes in vegetation and plant species contribution to the animal diet over the 9 months period. Pearson correlation test showed that the species cover percentage and their contributions to the sheep diet are generally related but each species and growth form had their own patterns in animal diet during the 9 months period. Generally with reduction in grasses cover, their contribution to the sheep diet is declined. For example, in the Davilat region, *Bromus tomentellus* cover reduced from 15 to 9% during 9 months that makes its 35 percent share in the sheep diet to decline to 12 percent (Fig 1&2). Decreasing grasses water and freshness in the period September to December can be another reason for reduction in Sheep willingness to grasses (Benvenuti et al 2006 & Ahmadi et al 2009). In the forbs, with their cover increment, their contribution to the sheep diet had increased (Askarizadeh et al 2010). Based on the field observations, it can be said that low cover of forbs like *Medicago minima* is the reason of low contribution of forbs to sheep diet; otherwise sheep is highly interested in forbs.

Although shrubs had no significant changes in cover percentage, but their proportion in the sheep diet were different over the 9 months period, for example, *Astragalus sp* contribution to the sheep diet was constant (25 to 35 percent) but *Artemisia aucheri* had little share in the sheep diet in the period April to September and even reached zero in the July but its share increased to more than 30 percent in the period September to December.

It shows in the long-term assessments, Shrub species should be studied separately while forbs and grasses had the same pattern during the period. It can be concluded too that, in the period April to September (spring and summer), grasses are considered more than shrubs by livestock due to freshness and quality, although their cover is less than shrubs. In September (the end of summer), there were a substantial increase and decrease in shrubs and grasses contribution to animal diet respectively. The increasing trend was continued during the period September to December, so that shrubs contribution to the sheep diet increased to 70 percent and grasses contribution decreased to less than 30 percent. Meanwhile, the average proportion of grass in the sheep diet was 50-60 percent in the period April to September and the average proportion of grass in the sheep diet was 30-40 percent in September.

The results show that season and vegetation composition have a large influence on sheep selection for plant species to graze (Schwartz & Ellis 1981; Van Niekerk & Abubeker 2009). It can be concluded that assessment of vegetation, its changes, and animals' diet should be done in long-term studies so that palatability and animals' interest to different species get clearly distinguished and it can be possible to understand the diet of livestock and measure husbandry system efficiency and effectiveness.

Acknowledgements

The authors thank the pastoralists in Baladeh Noor, North of Iran who shared their livestock management and provided information on sheep diet.

References

- 1) Ahmadi A, Sanadgol A, Mohsenisaravi M, Arzani H, Zahediamiri GH, 2009. Investigation of grazing behavior and diet selection by Zandi sheep. Pasture magazine, 3(2):245-257.
- 2) Arzani H, 2009. Forage quality and daily requirement of grazing animal. Tehran University press. 345p.
- 3) Askarizadeh D, Heshmati, GH, Mahdavi M, 2009. Investigation of diet selection of sheep on upland rangeland of northern Alborz(Case study: Javaherdeh's rangeland of Ramsar).Iranian Rangeland Journal., 10:413 -427.
- 4) Barani H, 2003. investigation of spatio-temporal pattern of grazing in eastern alborz. Phd thesis. Karaj Natural resources faculty. 321p.
- 5) Beck JL, Peek JM, 2005. Diet Composition, Forage Selection, and Potential for Forage Competition Among Elk, Deer, and Livestock on Aspen-Sagebrush Summer Range, Rangeland Ecol Manage 58:135-147.
- 6) Benvenuti MA, Gordon IJ, Poppi DP, 2006. The effect of the density and physical properties of grass stems on the foraging behaviour and instantaneous intake rate by cattle grazing an artificial reproductive tropical sward. Grass ForageSci. 61:272-281.
- 7) Butt B. 2010. Seasonal space-time dynamics of cattle behavior and mobility among Maasai pastoralists in semi-arid Kenya. Journal of Arid Environments 74 : 403-413.
- 8) Climate information, 2011. Weathering forecasting of Airport station of Baladeh.

- 9) Heydari GH, Barani H, Khoshfar GH, Ghorbani J, Aghili M, Mahboobi M, 2009. The role of social wealth on participation in performing pasteurizing projects based on the point views of their applicants(case study Balade pasture). *Pasture magazine*, 3(1):121-137.
- 10) Orr DM, Evenson CJ, Jordan DJ, Bowly PS, Lehane KJ, Cowan DC, 1988. Sheep productivity in an *Astrelba* grassland of South-west queensland. *Austral Rangeland Journal*. 10:39-47.
- 11) Rueda M, Rebollo S, Galvez-Bravo L, and Escudero A, 2008. Habitat use by large and small herbivores in a fluctuating Mediterranean ecosystem: Implications of seasonal changes. *Journal of Arid Environments*. 72: 1698– 1708.
- 12) Schwartz CC, Ellis JE, 1981. Feeding ecology and niche separation in some native and domestic ungulates on the short grass prairie. *J. Appl. Ecol.*, 18:343-353.
- 13) Van Niekerk WA, Abubeker H, 2009. Qualitative evaluation of four subtropical grasses as standing hay: diet selection, rumen fermentation and partial digestibility by sheep. *African Journal of Range and Forage Science*, 26(2): 69-74.
- 14) Van rees H, 1982 . The diet of free-ranging cattle on the bogong high plains, Victoria. *Austral Rangeland Journal*. 4:29-33.