VOL. 10, NO. 10, OCTOBER 2015 ISSN 1990-6145
ARPN Journal of Agricultural and Biological Science

www.arpnjournals.com

# STUDYING THE ALLOWABLE USE OF *Asperula glomerata* IN SEMI-STEPPE RANGELANDS OF IRAN

F. Ghasriani[1], A. Ehsani[2], A. Mohebby[3], E. Zandi Esfahan[4], Gh. Rahmani[5] and A. Farmahini[6]
[1,2,3,4,] Rangeland Research Division, Research Institute of Forests and Rangelands, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran
[5]Kerman Agricultural and Natural Resources Research Center, AREEO, Kerman, Iran
[6]Markazi, Agricultural and Natural Resources Research Center, AREEO, Markazi, Iran
E-Mail: zandiesfahan@gmail.com

**ABSTRACT**

Current research was performed in the selected sites of semi-steppe rangelands of Iran. *Asperula glomerata* is a key species in semi-steppe vegetative region including Enjedan (Markazi) and Kohpanj (Kerman) having a considerable portion in rangelands production of the mentioned flora. For this purpose, 40 similar *Asperula glomerata* were selected in each site. Selected species were exposed to different harvesting intensities of 25, 50 and 75% and zero as control group. Data were analyzed by SPSS and MSTATC, and Duncan's Multiple Range Test was used for mean comparisons. Our results clearly showed that a harvesting intensity of 25% could be recommended as the best allowable use for *Asperula glomerata* in this vegetative region and other similar areas.

**Keywords:** *Asperula glomerata*, forage production, allowable use, rangeland.

## INTRODUCTION

Rangelands are one of the most important and most valuable national resources of Iran, forming a large part of the country (over 52%). Other services of the rangelands including pharmaceutical, industrial, and food products, soil conservation, control and increased groundwater storage, fresh air, the raise of relative humidity, regulation of the water cycle in nature, providing forage for livestock, preservation of plant and animal genetic resources as well as wildlife are important nationally (Fazilati *et al*., 1965). It is noteworthy to state that providing forage for grazing livestock is the main use of rangelands, while forage quantity and quality are inadequate to provide the forage needed for livestock due to overutilization (Gharedaghi and Fazel Najafaabadi, 2000). However, providing forage for grazing livestock is the main use of rangelands but the quantity and quality of forage is unsatisfactory and could not provide forage needs of livestock.

Despite the major role of determining the allowable use of important species, unfortunately, a few systematic researches have been done in this regard. Therefore, the main purpose of this study was to determine the allowable use of a key range species namely Asperula glomerata in selected sites of semi-steppe rangelands of the country. The main question of the study is that to what extent of harvesting can be tolerated by this species.

The results of other studies in this filed are as follows:

Smith *et al.*, (2007) introduced range condition as one of the most important criteria in determining the level of range utilization and stated that observing the allowable use of the rangelands with poor condition would result in rangeland improvement. In addition, allowable use should be considered higher in the rangelands with good condition while it should be lesser in poor rangelands. Arzani (2010) stated that allowable use percentage varied depending on plant species and if it is calculated for desirable species, it could be used for all plant species. Reece *et al.*, (2001) developed a theory on allowable use, which is expressed as half harvesting and half remaining and according to it; the livestock are permitted to graze a distinct percentage of available forage that its rate is typically 50%. Amiri (2008) estimated an allowable use between 20 to 40 percent in rangelands of Semirom of Isfahan. Zhao and Lin (2007) in studies of some range species stated that a number of range species cannot tolerate the pressure of forage harvesting and therefore are unable to offset declining production resulted from cutting shoots. Sharifi and Akbarzadeh (2010) studied the changes in the vegetation under exclosure and grazing conditions in rangelands of Ardebil (Arshagh site) and reported that species of *Stipa hohenackeriana* showed a considerable growth. Ganskcopp (1988) investigated the effect of harvesting intensities on changes of forage production of *Stipa thurberiana* at Range Research Station of Oregon and concluded that this species was prone to intense harvesting in vegetative stage and only in the case of light harvesting it can be used multiple times during the growing season. Fulstone (2009), in his studies on grazing management of Missouri rangelands reported the allowable use of key species of *Stipa californica* and *Stipa nevadensis*, as 50 and 55%, respectively. The allowable use of range species including *Bromus tomentellus*, *Festuca ovina* and *Stipa hohenackerian*, and *Atriplex leucoclada* in different vegetative regions of Iran were reported to be 75%, 25-50%, and 25%, respectively (Gasriiani *et al.*, 2013; Gasriiani *et al.*, 2014).

As was mentioned, determining the allowable use is dependent on the studies in place, and its percentage will vary depending on the species. Therefore, this research was aimed to determine the allowable use of *Asperula glomerata* in the reference sites of the semi-steppe region for 4 years.

## MATERIAL AND METHODS

### Characteristics of the selected sites of semi-steppe regions

Characteristics of the selected sites of semi-steppe are summarized in Table-1.

**Table-1.** Characteristics of the selected sites of semi-steppe region.

| Row | Site | Region | Altitude (a.s.l) (m) | Average annual precipitation (mm) |
|---|---|---|---|---|
| 1 | Enjedan | Markazi | 2000 | 327 |
| 2 | Kohpanj | Kerman | 2560 | 270 |

In each of the selected sites, *Asperula glomerata* was evaluated as a key species. Therefore, 40 similar stands were selected at the beginning of the grazing season in each region and were marked by wooden labels. These labels remained stable and were protected from livestock grazing during four years. In this research, grazing simulation was performed in which different harvesting intensities of 25, 50, 75% and 0 (as control) were investigated as treatments with 10 replications for each treatment. Harvesting was done with clippers. Since forage harvesting was commenced from the beginning to the end of livestock grazing, therefore, the number of days that species were normally grazed by livestock was calculated in each region and then it was divided by 30 to get the number of harvesting. Residual forage and total forage of the control treatment were harvested when species were completely dry. Thereby, total yield was calculated in each year.

### Statistical analysis

A split plot design in time with 10 replications was used, and data analysis was performed with SAS software. Mean comparisons were done by Duncan's Multiple Range Test. Interactions between treatments were tested by AMMI model, using IRRISTAT software. Other items, investigated in this study, included assessment of plant mortality, height, seed production and meteorological data.

## RESULTS

According to the results of analysis of variance during 2006-2009 (Table-2), the effects of year, harvesting intensities and location and also the interaction of location and year effects on forage production of *Asperula glomerata* were significant at 1% level of probability.

**Table-2.** Analysis of variance of harvesting intensity, year and location on forage production of *Asperula glomerata.*

| Source of variations | Degrees of freedom | Mean squares |
|---|---|---|
| Location | 1 | 315.6** |
| Year | 3 | 578.8** |
| Year * Location | 3 | 401.9** |
| Error (1) | 72 | 6.38 |
| Harvesting intensities | 3 | 29.8** |
| Harvesting intensities *Location | 3 | 26.06** |
| Harveingst Intensities* Year | 9 | 3.52** |
| Year * Site * Harvesting Intensities | 9 | 3.13** |
| Error(2) | 216 | 0.59 |
| cv | | 12.18 |

Mean comparisons of forage yield of the selected individuals related to each year, harvesting intensity and location were performed by Duncan's Multiple Range Test (Table-3). Results of mean comparison of the effect of year on forage yield showed that maximum forage yield was recorded for 2006. In addition, maximum forage yield was obtained for control treatment. There were significant differences among the studied sites statistically so that maximum yield was recorded for the site of Kohpanj (7.35gr).

**Table-3.** Mean comparisons of forage production of *Asperula glomerata* in years, locations and different harvesting intensities.

| Treatments | Forage yield (g) |
|---|---|
| 2006 | 9.21a |
| 2007 | 3.05d |
| 2008 | 7.67b |
| 2009 | 5.42c |
| Control | 7.03a |
| 25 % | 6.62b |
| 50 % | 6.04c |
| 75 % | 5.65d |

| | |
|---|---|
| Kohpanj | 7.35a |
| Enjedan | 5.34b |

Mean comparisons of interaction effects of location and different harvesting intensities performed by Duncan test are presented in Table-4. According to the results, maximum and minimum yield was obtained in the site of Kohpanj at harvesting intensities of 50% (13.17gr) and 25% (1.47gr), respectively.

**Table-4.** Mean comparison of interaction effects of location, different harvesting intensities and year on forage production of *Asperula glomerata*.

| Site | Harvesting intensities | Forage yield (g) | Duncan grouping |
|---|---|---|---|
| Kohpanj | 50 % | 13.17 | a |
| Kohpanj | Control | 12.76 | a |
| Kohpanj | 25 % | 12.51 | a |
| Kohpanj | 75 % | 12.02 | a |
| Kohpanj | 50 % | 10.36 | b |
| Kohpanj | Control | 10.02 | b |
| Kohpanj | 75 % | 9.9 | b |
| Kohpanj | 25 % | 9.4 | b |
| Enjedan | Control | 7.81 | c |
| Enjedan | 25 % | 6.9 | dc |
| Enjedan | Control | 6.81 | dc |
| Enjedan | 25 % | 6.31 | def |
| Enjedan | Control | 6.21 | def |
| Enjedan | 25 % | 6 | def |
| Kohpanj | Control | 5.59 | dgef |
| Enjedan | 50 % | 5.51 | dgef |
| Enjedan | 75 % | 5.51 | dgef |
| Enjedan | Control | 5.51 | dgef |
| Kohpanj | 25 % | 5.31 | hgef |
| Kohpanj | 75 % | 5.2 | hgef |
| Enjedan | 25 % | 5.1 | ihgef |
| Kohpanj | 50 % | 4.97 | ihgef |
| Enjedan | 50 % | 4.6 | ihgjf |
| Enjedan | 50 % | 4.2 | ihgj |
| Enjedan | 50 % | 4.01 | ihj |
| Enjedan | 75 % | 4 | ihj |
| Enjedan | 75 % | 3.7 | ij |
| Enjedan | 75 % | 3.4 | j |
| Kohpanj | Control | 1.56 | k |
| Kohpanj | 50 % | 1.53 | k |
| Kohpanj | 75 % | 1.51 | k |
| Kohpanj | 25 % | 1.47 | k |

**DISCUSSIONS**

Our findings showed that in semi-steppe region, a better distribution of key species was reported under a harvesting intensity of 25% whereas harvesting intensities of 50% and 75% negatively affected the growth parameters of this species. This result is in agreement with

the findings of Zahedi, (2011) in rangelands of Majidabad of Kordestan province, and Fulstone (2009) who studied the allowable use of *Stipa nevadensi* as a key species in Missouri rangelands and Holechek *et al*., ( 2003) in arid rangelands of South West USA but (Sharifi Yazdi, 2009, Zare, 2012) performed in rangelands of Dhno (Kerman province) and Nodoushan (Yazd province) respectively, showed that a harvesting intensity of 50 percent was the best allowable use for *Stipa barbata* in the mentioned sites.

## CONCLUSIONS

As a result, a harvesting intensity of 25% could be recommended for *Asperula glomerata* in the studied sites and other similar areas.

## RRFERENCES

Amiri F. 2007. Multipurpose model for rangeland by using GIS (case study: Ghara aghagh Semirom catchment). Ph.D. thesis, Islamic Azad University, Science and Research Branch, Tehran, Iran.

Arzani H. 2010. Range Analysis (M.Sc. Booklet), Faculty of Natural Resources, University of Tehran.

Fazilati A, Hosseini Araghi H. 1965. Country rangelands and management, adjustment and reclamation methods of it, Range engineering office press.

Forward J R, Magai M M. 1992. Clipping frequency and intensity effects on big bluestem yield, quality, and persistence. Journal of Range management. 45(6).

Fulstone F. 2009. Annual operating instruction in Missouri flat allotment for the 2009 grazing season. United States department of agriculture, Forest services, Humboldt-Toiyabe national forest, file code: 2210.

Ganskopp D. 1988. Defoliation of Thurber needlegrass: herbage and root responses, Journal of Range management. 41(6).

Gasriiani F, Mohebby A, Zandi Esfahan E. 2013. Determination of allowable use for Stipa hohenackerian in semi-steppe rangelands of Iran. Journal of Biodiversity and Environmental Sciences. 3(6): 1-7.

Gasriiani F, Zandi Esfahan E, Mohebby A. 2013. Determination of allowable use for *Festuca ovina* in semi-steppe and mountain rangelands of Iran. Journal of Biodiversity and Environmental Sciences. 4(3): 77-83.

Gasriiani F, Mohebby A, Zandi Esfahan E. 2013. Determination of allowable use for *Bromus tomentellus* in semi-steppe and mountain rangelands of Iran. Journal of Biodiversity and Environmental Sciences. 3(11): 84-91.

Gasriiani F, Mohebby A, Zandi Esfahan E. 2013. Determination of allowable use for Atriplex leucoclada in Khalij-O-Omani rangelands of Iran. Journal of Biodiversity and Environmental Sciences. 4(1): 1-7.

Gharedaghi H, Fazel Najafaabadi M. 2000. Seasonal changes in carbohydrate reserves in the key plants of Polour area. The second national range and rangelands management conference, Tehran, pp. 16-18.

Holchek J. L. 1991. Chihuahuan Desert rangeland, Livstock grazing and sustainability. Rangelands. 16, 237-240.

Holechek J.L, Cole R, Fisher J, Valdez R. 2003. Natural resources, ecology, economic and policy. Rangelands. 26, 118-223.

Moghaddam MR. 1998. Range and Range Management, University of Tehran. 470 p.

Reece P E, Alexander J D, Johnson J R. 2001. Drought management on range and pastureland, a handbook for Nebraska and South Dakota, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

Sharifi J, Aliakbarzade E, Azimi F and Hekmatjo S. 1388. Study of the Exclosing effect on health and trend of natural ranglands of Ardabil province, RIFR, N frost. 88/843.

Smith M.V. 2007. Effect of stocking rate and grazing management on the persistence and production on dry land on deep sands. Proc. Int. Grassland Cong. 9: 624-628.

Smith L, Rule G, Maynard J, Barker S. 2007. Principles of obtaining and interpreting utilization data on rangelands, The University of Arizona Cooperative Extension.

Tavakoli H, Hodgson J, and Kemp PD. 1993. Responses to defoliation of tall fescue. Proceedings of the XVII International Grassland Congress.

Zahedi S. 2011. Studying the allowance forage of the important range species in Majidabad paddock, final report of project, Kordestan, Research Institute of Forests and Rangelands, Iran.

Zare MT. 2012. Studying the allowance forage of the important range species in Nodoushan rangelands, final repor of project, Yazd, Research Institute of Forests and Rangelands, Iran.

Zhao w, Chen S P, Lin G H. 2007. Compensatory growth responses to clipping defoliation in *Leymus chinensis* (Poaceae) under nutrient addition and water deficiency conditions. Plant Ecology DOI 10.1007/s11258-007-9336-3.