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Determining the Allowable Use for *Dactylis glomerata* in Semi-Steppe Rangelands of Iran

F. Ghasriani[1], E. Zandi Esfahan[1*], A. Mohebby[1], R. Khalifehzadeh[1], H. Nasiri Dashtaki[2], K. Saedi[3] and S. Rashvand[4]

[1]Rangeland Research Division, Research Institute of Forests and Rangelands, Agricultural Research Education and Extension Organization (AREEO), Tehran, Iran; zandiesfahan@gmail.com, fghasriani1330@yahoo.com, yasharmohebby@yahoo.com, khalifehzadeh@ymail.com
[2]Department of Agronomy, Firrozabad Branch, Islamic Azad University, Fars, Iran; hnd2000li@yahoo.com
[3]Kordestan Agricultural and Natural Resources Research Center, AREEO, Kordestan, Iran; kazemsaedi@yahoo.com
[4]Qazvin Agricultural and Natural Resources Research Center, AREEO, Iran; saeedrashvand@yahoo.com

Abstract

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

Keywords: Allowable Use, *Dactylis glomerata*, Forage Production, Semi-Steppe Rangelands

1. Introduction

In Iran, rangelands with an area of 86.1 million hectares include more than 50 percent of the country's area, which can produce 10 million tons of dry matter[1]. These lands have a wide variety of functions including soil erosion control, underground aquifers feeding, recreation, medicinal plants, and forage production to feed livestock and wildlife[2]. Nowadays, detailed and accurate information of rangeland production is crucial to determine short-term and long-term grazing capacity. To estimate available forage, palatability and allowable use need be taken into consideration. According to[3], palatability is related to the characteristics of plants, causing increased livestock motivation to select plant species. In[2] palatability defined as a part of plant that can be used by livestock with no damage or injury to the growth or plant life. The factors affecting allowable use include climate change, soil conditions, erosion in the region, grazing season, range condition and range trend[2].

Therefore, determining allowable use is one of the basic principles of range management in terms of avoiding forage loss and plant damage[4].

The primary use of orchardgrass (*D. glomerata*) is for pasture and hay forage production[5]. It is highly palatable to all classes of livestock. It is one of the best forage grasses for use in the Northern states under intensive rotational grazing systems. It is compatible with many legumes (alfalfa, birdsfoot trefoil, and various clovers) and with some grasses such as perennial ryegrass and tall fescue[6]. The life cycles of orchardgrass and alfalfa match well. Because of its dense network of non-rhizomatous roots, orchard grass provides good erosion control on sites where it is adapted. It is recommended for erosion control on forestland that has been burned or logged, often showing early establishment and eventually being replaced by

* Author for correspondence

native vegetation or other seeded species[6]. Orchardgrass can use high rates of Nitrogen (N) when grown on deep soils with adequate water supplies, making it valuable in nutrient recycling systems. It can be used in manure and biosolid applications to recycle large amounts of N (in excess of 300 pounds N/ac/yr) while simultaneously producing high quality forage[6].

D. glomerata is one of the most palatable species in semi-steppe rangelands of Iran and determining its allowable use is of utmost importance.

The main question of the study is that to what extent of harvesting can be tolerated by this species. 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 *D. glomerata* in the reference sites of the semi steppe region for 4 years.

2. Material and Methods

2.1 Characteristics of the Selected Sites of Semi-Steppe Region

The characteristics of selected sites in semi-steppe region are shown in Table 1.

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

Row	Site	Province	Altitude (a.s.l)(m)	Averageannual precipitation (mm)
1	Alamot	Gazvin	2400	584.4
2	Saral	Kurdistan	2225	452

In each of the selected sites, *D. 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 specific labels of wood. 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 percentand 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.

2.2 Statistical Analysis

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

3. Results and Discussion

The results of analysis of variance during 2006-2009 (Table 2), indicated that the effects of year, harvesting intensities and location and also their interaction effects on forage production of *D. glomerata* were significant at the confidence level of 95 percent.

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

Source of variations	Degrees of freedom	Mean squares
Location	1	16.94ns
Year	3	838.6**
Location* Year	3	141.07**
Error(1)	52	11.7
Harvesting Intensities	3	30/9*
Location* Harvesting Intensities	2	35.2*
Year* Harvesting Intensities	9	18.31ns
Harvesting Intensities* Site* Year	6	30.28*
Error(2)	120	10.42
cv		47.23

(**) significant at 1% level of probability (*) significant at 5% level of probability (ns) non significant

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). According to the obtained results,significant differences were recorded for the effects of year and the interaction of location* year ($p<0.01$), and different harvesting intensities ($p<0.05$) on forage yield of *D. glomerata*. Maximum and minimum forage yield was obtained in 2006 and 2007, respectively. Results of mean

comparisons showed that maximum forage yield was obtained for control treatment (0 percent).The difference between 25 percent and 75 percent harvesting intensity was not significant. Minimum forage yield was obtained at 50 percent harvesting intensity. In addition, there were not significant differences among the studied sites statistically and maximum and minimum yield were recorded for the site of Alamot (7.51 gr) and Saral (6.38 gr), respectively.

Table 3. Mean comparisons of forage yield of *Dactylis glomerata* in years, locations and different harvesting intensities

Treatments	Forage Yield (g)
2006	13.57 a
2007	3.53 c
2008	5.3 b
2009	4.8 b
Control	8.96 a
25 %	7.31 b
50 %	5.76 c
75 %	6.72 bc
Alamot	7.51 a
Saral	6.38 a

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 yield was obtained for 25 percent harvesting intensity (20.8 g) in the site of Saral in 2006, and minimum yield was recorded for a harvesting intensity of 50 percent in the site of Saral (2.29 g) in 2007.

Different results were recorded in the study sites in terms of yield of *D. glomerata* in control group as compared to the harvesting intensity treatments. The harvesting intensities of 50 percent and 75 percent resulted in an expected decline of production.

With respect to both sources of variations in rangelands (livestock grazing as the main management factor and annual climate conditions), it can be stated that grazing, even at a grazing intensity more than 50 percent, could cause damage to the height and consequently yield of *D. glomerata* in the study area and other similar ecological zones. It is noteworthy to state that a harvesting intensity of 75 percent resulted in producing more reproductive stems. It may be due to the compensation for damage caused by harvesting and for the survival of the population through higher seed production.

A rainfall of 736 mm, with proper distribution and temperature, occurred in 2006, leading to higher yield of this species under different harvesting intensities in 2008 as a normal year. On the other hand, an increase of yield was obtained in wet year (2006) in response to a harvesting intensity of 25 percent.

Our results clearly showed that *D. glomerata* was amesophyte species rather than xerophyte, and for this reason, it tolerates livestock grazing better in wet years with higher performance and denser population in wetter areas. This result is in agreement with the earlier findings[5,7]. In[8] stated that there was a strong correlation between rainfall and forage yield in regions having a rainfall less than 500 mm. Generally, the negative effects of harvesting treatments on *D. glomerata* became more apparent gradually in the final years of the study.

Table 4. Mean comparison of interaction effects of location, different harvesting intensities on forage production of *Dactylis glomerata*

Site	Harvesting Intensities	Forage Yield (g)	Duncan Grouping
Saral	25 %	20.8	a
Saral	75 %	13.57	b
Alamot	Control	13.18	b
Alamot	50 %	11.44	bc
Alamot	Control	11.06	bc
Saral	50 %	10.88	bc
Alamot	25 %	10.76	bc
Alamot	75 %	9.88	bcd
Alamot	25 %	8.94	ced
Alamot	50 %	8.24	cfed
Alamot	Control	6.6	gfed
Alamot	75 %	6.34	gfed
Alamot	50 %	5.9	gfed
Saral	75 %	5.89	gfed
Alamot	25 %	5.28	gfe
Alamot	75 %	5.24	gfe
Alamot	Control	5.02	gfe
Alamot	25 %	4.68	gfe
Saral	75 %	4.32	gf
Alamot	50 %	4.05	gf
Saral	75 %	4.01	gf
Saral	50 %	3.82	g
Alamot	75 %	3.64	g
Saral	25 %	3.22	g
Saral	50 %	2.77	g
Saral	25 %	2.63	g
Saral	25 %	2.38	g
Saral	50 %	2.29	g

4. Conclusion

Our results clearly show that this species could be recommended in range improvement practices where rainfall is between 550-600 mm. According to the obtained results, a harvesting intensity of 25-50 percent could be recommended for *D. glomerata*, considering the average condition of all sites in which it was selected as a key species.

5. References

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