Effects of Enclosure, Rest-delayed and Continuous Grazing Treatments on Production Rate and Vegetation Cover of SadrAbad Nodoushan of Yazd Pastures

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Abstract. In this investigation, the effects of enclosure, restal delayed grazing and continued grazing treatments on the production rate and vegetation cover were studied. Study area was SadrAbad pasture. After selecting three bands (1+1+1=3 hectare area) as three treatments in the restricted and non restricted area, they were transected to three transects. Then plots ($1\times2m^2$) were selected to measure the production rate with clipping and weight method and vegetation cover was determined. The data were analyzed using Duncan test in completely randomized block design. As the results showed, the production and vegetation cover percentage in enclosure area, the restal delayed grazing and continued grazing had significant differences($p<0.01$).

Key words: SadrAbad, Enclosure, Continued Grazing, Production, Vegetation Cover, Duncan Test.

Introduction

Pastures are defined as ecology of natural systems characterized by their original vegetation. Stability, balance and duration of systems are affected by the interaction of climatic factors, soil and living creatures. Pastures with numerous potentials developed and evolved during the centuries to be exploited by human beings using all the facilities fundamentally and continuously. Unfortunately, lack of proper management of natural resources in the natural areas, particularly pastures caused some changes in the composition of the vegetation so that valuable natural species are placed by palatability and toxic species. Some measures should be done in this case and present the proper management to sustain and make this great source stable. This study aims to evaluate different treatments on the production and vegetation. Several researches done in this field indicate that some management practices such as short and long term prevention of livestock grazing in the pasture lead to the improvement of plant composition, increased production, vigor reinforcement and vitality of plants, increased seeds, increased food storage in the aerial and underground organs and establishment of seedlings (Trlica and Cook 1971).

Intensity of livestock grazing in the pasture has a direct effect on the production and composition of vegetation leading to the emergence of more poor species, decreased carbohydrate storage and reduction of pasture production (Trlica and *et al.* 1977, Tavakoli and *et al.* 1992). Nowadays, experts have concluded that with long-term grazed, pastures status and trends are occasionally positive (Vahabi, 1989).

The results of statistical research done by Mirza Ali *et al.* (2006) in Golestan Gomishan pastures showed that canopy cover of species within the enclosure was significantly higher than outside the area, the form of plant growth outside the enclosure and multi-year Forbs inside the enclosure had the highest percentage of vegetation composition, the density rate of dominant species within the enclosure was significantly reduced and the production rate within the enclosure was significantly more than outside the area.

The pattern of plant growth outside the exclosure and one year wheats within the exclosure had the highest production. The effects of nineteen-year exclosure and the grazing on the vegetation changes in south of Zanjan city were investigated by Aghajanlou *et al.* (2006). The obtained results showed that the palatability of valuable plant species of class I in the exclosure had a significant difference compared to the adjacent area and 280 percent increase was observed. The composition of invasive plants within the enclosure was considerably reduced in comparison with the grazing region.

The plant growth and production were approximately doubled compared with the adjacent area. The proper grazing of the pasture plants stimulates their growth and the excessive continuous grazing weakens and destroys the plants (Vallentine, 1989). Planned grazing aims to minimize the grazing damages, maintain the watershed values, and increase the continuous forage, pasture and livestock products (Vallentine 1989). James (2001) Performing a study on the grazing systems concluded that if the grazing systems are properly designed, there won't be any problems for feeding the livestock and the rangeland will have a permanent forage source. Through a research, Larry (2010) stated that the grazing system will be successful if the segmentation, grazing season, utilization rate and water resources are carefully designed in the region. Karimian *et al.* (2009) surveyed the success and failure reasons of grazing system implementation in the winter rangelands in Semnan. The results showed that the implementation of grazing systems were not successful for 77 percent. The failure reasons include lack of livestock management (33%), lack of attention to shepherd guides (25%), incompatibility with nature (22%) and

non-implementation of appropriate grazing system (20%). A research was done in 2009 at Iowa University related to the advantages and disadvantages of grazing systems. The advantages of continuous grazing system are the lowest investment cost and its easy execution; meanwhile there are no grazing restrictions. Some of the disadvantages are as follows: some parts of the rangeland will be damaged due to the grazing, some parts will have the intact forage, palatability of the species will be destroyed and soil erosion will occur. In periodic grazing, the rangeland is divided into several parts and some parts will rest for a while. The benefits of rested parts are that the plants have a good growth pattern and will be strong and in comparison with the continuous grazing, forage production is more. Though this system requires fencing which is highly costed.

The research objectives

1- Studying the effect of different grazing treatments on the plant vegetation and production

2- Studying the exclosure effect on production rate and plant vegetation

Materials and Methods

Region geographical status

This plan has been performed in a place located in North West of Yazd province. This region is known as SadrAbad Rangeland which is placed in Nadooshan. Sadr Abad is perches on 53°, 37´ and 40´ eastern longitude and 31°, 52´ and 55´ northern latitude.

Its climate is cold and dry based on Amberegeh climate classification. Ten-year average of rain and the annual temperature average are 140 mm (Table 1). and 13.3 ° C, respectively. Its soil is classified as Anti Soil in relatively inclined areas and Aridy Soil in flat areas. The dominant plant types are *Artemisia aucheri and Zygophyllum eurypterum* and its associated species are as follows: *Acantholimonsp sp, Peteropyrum aucheri, Lactuca orientalis, Astragalus sp. Acanthophyllum sp*. is. The floristic list of studying area has been shown in Table 2.

Table 1. Ten-year Average Rainfall in the Study Area

Year	Rainfall(mm)
70-71	145
71-72	136
72-73	152
73-74	142
74-75	159
75-76	137
76-77	127
77-78	128
78-79	132
79-80	142

Table 2. Condition of plant cover in tree area (continuous grazing, rest delay grazing and enclosure)

Continuous grazing			Rest delay grazing			enclosure			*** *****
Vegetation composition (%)	Mean Cover (%)	Mean Yeild (kg/hec)	Vegetation composition (%)	Mean Cover (%)	Mean Yeild (kg/hec)	Vegetation composition (%)	Mean Cover (%)	Mean Yeild (kg/hec)	Plant species
3.2	35	44.3	3	32	54.3	5.2	45	91.3	*Artemisia Aucheri*
3.3	33	47.2	3	33	53.6	5.3	47	87.6	*Peteropyrum Aucheri*
6.1	38	45.1	3.8	38	55.1	4.4	45	85.1	*Polygonum rottboellioides*
4.5	39	41.1	4.4	39	57	3.4	41	89.9	*Salsola kalli*
4.6	37	40.6	4.7	41	59	3.5	41	87.3	*Peganum harmula*
4.4	34	42	4.5	40	54.2	4.3	42	84.9	*Scorzonera tortuosissima*
4.5	39	44	4.4	39	49	3.8	44	87	*Cousinia calcitrapa*
4	32	51	5.7	44	55.9	6.9	51	86.9	*Carthamus oxyantha*
4.3	34	41.9	5.2	42	61	4	42	84.4	*Launaea acanthodes*
4	35	49.2	6.3	44	57	4	44	89	*Neogaillonia eriantha*
4.5	36	44.3	6.2	42	44.2	4.9	42	90	*Cornulaca monacantha*
3.3	30	45	6.3	44	49.3	5.5	45	89.9	*Cleome coluteoides*
3.3	31	44.4	6.3	44	52.2	4.2	44	89.8	*Dendrostellera lessertii*
5.7	41	45	5.1	41	55.5	4.3	45	88.2	*Carex physodes*
5.5	40	45.8	5.2	40	56.8	4.5	45	88.9	*Eremopysum bonapartis*
3.5	32	47.7	6.1	42	58	5.8	42	88.1	*Bromus tectorum*
5.6	39	49.2	4.6	39	59	5	45	86.3	*Astragallus albispinus*
5.7	42	48	5.1	41	48	5.1	48	84	*Schumannia karelinii*
5.7	41	45	5.1	42	50	4.1	45	90.1	*Linaria michauxii*
5.9	44	40.1	4.8	40	57	4	40	89	*Boissiera squarrosa*
5.4	40	40	4.9	40	54	3.9	40	90.2	*Ephedra strobilaceae*
5.8	43	44.3	5	43	49.1	4.3	43	88	*Lactuca oriantalis*

Survey Method

In this study, the rangeland is equally divided into three parts being one hectare. The survey started in 1996 and ended in 2001.The first piece of rangeland was grazed for 5 years (1996-2001). The second piece with one year rest treatment was grazed after a two-month delay and in the third piece, continuous grazing treatment was performed. In each one hectare piece, three 100 m transects as three replications were placed perpendicularly on the slope. On each transect, ten (2×1 square m) plots were selected and the production rate was measured using clipping and weighing method and the cover percentage within the plots. Vegetation cover and production rate were measured during the studying years in the fixed plots on the transect at the end of plant growth after grazing the livestock composed of sheep and the grazing began from May 15 and continued for about four months. According to the calculations, the allowed number of livestock entered the rangeland. Statistical results were analyzed using Duncan's test

at 1 and 5 percent error in a completely randomized block design.

Results

Duncan's test results presented in (Table 3) show that the mean of vegetation cover percentage and production rate in the grazed treatments, rest - delayed and continuous grazing are significant. Mean of plant cover percentage in the grazed treatment is more compared to the continuous grazing and the rest - delayed treatment is more than the continuous grazing. The production average in the grazed and rest - delayed treatments are more than the continuous grazing (Table 3 and Fig.1). Table 4, shows that the vegetation and production rate in different treatments at 1 percent error level has a significant difference. ($p<0.01$).

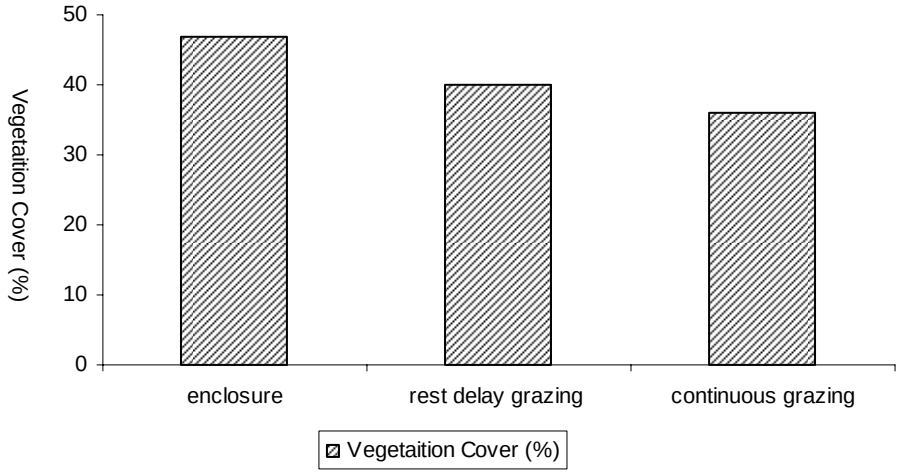

Fig.1. Mean Percentage Vegetation Cover in Different Treatments

Table 3. Compare the Mean Percentage Vegetation Cover and Yield in Three replicates

Continuous grazing	Rest delay grazing	enclosure	Index
^{d} 35.3	^{bc} 40.1	^{a} 47.2	Cover (%)
^{d} 44.1	^{b} 53.2	^{a} 88.3	yield

Table 4. Variance from the Results of Yield Rate and Coverage in Different Treatments

		Mean square	
S.V	DF	Yeild(kg/hec)	Cover (%)
Treatment	2	**387.4	**72.3
Repeat(Block)	2	217.3	44.7
Error	4	144.3	40.1
CV	-	17.48	11.4

Discussion and Conclusion

Although SadrAbad rangeland is considered as a relatively good rangeland in Yazd province, various treatments such as exclosure and different grazing have an important effect on the rate of vegetation cover and production. During this experiment implementation, the growth of low palatable plants has been shifted to the benefit palatable plants, especially *Astragalus sp*. In all treatments which are due to the positive effects of exclosure, resting the rangeland and delaying the grazing in the early stages of plant growth.

Such results have also been reported in other sources (Vahabi 1997, Amrollahi and Zare 2000). On the other hand, the species diversity in the exclosure is more than the grazed pasture, therefore, it is expected that since such species diversity is more, the forage rate and vegetation cover percentage are higher which is verified in this study Ejtehadi *et al.* (2001).

But in this research, the vegetation cover and production rate in grazed treatments were more than the resting-delayed grazing treatment because being exclosed for grazing improved the composition of species cover and diversity. It can be observed that in the 5 year exclosed region in Mashhad, the species diversity has been more than the grazing area. According to the above mentioned reasons, the vegetation coverage and production rate are higher in the grazed area. Ejtehadi *et al.* (2001).

Vegetation coverage and production rate in the resting-delayed grazing treatment are more than the continuous grazing because there will be an opportunity for the plant in the rangeland to reach the growth, development and storage stages in the former treatment, but this chance is not observed in the continuous grazing and without the delay and rest, the forage is eaten by the livestock. Therefore, it is obvious that the vegetation cover and forage rate are relatively increase due to the branch and leaf growth .In the other hand, delaying the grazing time in which the perennial plants grow appropriately and the annual plants are seeding has a considerable effect on the rangeland survival. These results are confirmed using the results obtained by Tavakoli (2001).

Climate factor influences the vegetation cover. The most effective climatic factor is considered as the precipitation of growing season. After that, the annual rainfall is one of the important indices affecting the forage production. Based on the results obtained by Hanson (1982), the moisture created by the rainfall of growing season is stored in the soil to be used by the plants. There is a linear relationship among this year rainfall, that of two years ago and production. This result confirms the research conclusion Johns *et al.* (1983).

If there is good rainfall, the opportunity for a suitable growth will be provided for the plants in the rest-delayed and grazing treatments compared to the continuous grazing because the plants should consume the nutritious materials in a short time in the grazing treatment and the plant won't grow well. Therefore, the vegetation covers and production averages will be fewer than the previous two treatments. The grazing management in the pasture is the regular and homogeneous consumption of forage. The livestock control is a dynamic art and should be done by understanding the factors that can affect the fluctuation of forage consumption. Providing the appropriate opportunities for the improved livestock grazing including periodic, delayed or rest treatments on the pasture is somehow an exclosure.

If we want to confirm one of the above-mentioned treatments as the positive treatment for increasing the forage production and vegetation percentage, we will recommend the rest-delayed treatment. In addition to the opportunities for the vegetation growth and revivification of pasture plants, providing conditions to revive vegetation and the quality and quantity improvement, the exclosed treatment can create conditions to increase the production of pastures, prevent further soil erosion and protect the areas in which the soil erosion is accelerated because of poor vegetation. The increase of palatable species, the vegetation composition change and revivification of suitable species based on the climate conditions of the grazed area, preserving the rare species and their regeneration opportunities have also some disadvantages such as the plant pests (allelopathy) in the exclosure.

When a piece of pasture (e.g. an exclosure) is not grazed by a livestock, an increased pressure will be imposed on the other parts

and the ranchers ough to provide their livestock food necessity from other sources such as manual gathering of forage grass (barley, hay, bran, etc.), renting cultivative grazing area (products remaining after harvest) and so on, which impose a high cost on them. Therefore, there are 916000 families depended on the pastures; while this rate is five times more than the existing pastures in the country. To reach the equilibrium of rangelands, we should move in a direction that the current operation units change into the optimal exploitation units to be able to provide their family necessities and reduce the pressure on the pasture vegetation. The application of these techniques will meet the rancher's needs.

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