International Journal of Agriculture Innovations and Research
Volume 3, Issue 1, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 26/05/2014 | Accepted on : 31/05/2014 | Published : 02/07/2014

The Impact of Livestock Grazing Management on the Soil Properties of Gardaneh Zanbouri Rangeland of Arsanjan, Iran

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***Abstract* – Livestock grazing, especially heavy grazing, transforms soil properties. Because proper management of range ecosystems requires knowledge of the modifying and effective factors it as well as knowledge of relations governing components of ecosystems, this study was carried out to evaluate the intensity livestock grazing effect on some of the soil characteristics in Gardaneh Zanbouri Rangeland of Arsanjan. For this reason, in three zones: main, key and critical, Soil sampling was carried out according to systematic random sampling, and from two horizons of 0-15 cm and 15-30 cm. In each horizon, 5 samples were taken and the factors such as conductivity, PH, percentage of clay ingredients, silt, sand and soil moisture were measured. Data analysis was performed in SPSS and mean values of each factor between areas with different intensities by Tukey test. The results of two-way ANOVA analysis and Tukey test showed that there was not any significant difference between the critical and main zones in terms of acidity. But at the key area the value of acidity was more than the other two districts. Also, increasing the grazing intensity led to a decrease of soil moisture, while electrical conductivity was increased.**

***Keywords* – Arsanjan, Acidity, Soil Texture, Moisture, Grazing Management, Conductivity.**

I. INTRODUCTION

Uncontrolled exploitation of ranges and overgrazing are the major causes of natural resources destruction in global level. Cover crop destruction caused by various factors especially heavy grazing, uncontrolled grazing, unsuitable as timing and beyond the capacity of ranges has the adverse effects in increasing of soil erosion and runoff volume and sediment production. Johnston *et al*. (1971), reported in Alberta range soils, soil pH has increased in low grazing from 5.7 to 6.2 in heavy grazing. Menzes *et al*. (2001), have not found any significant differences in terms of soil acidity among the enclosure zone and the area under the grazing. Mousavi (2001), was studied the enclosure effects on soil and vegetation in Semnan steppe ranges and concluded that the acidity value in outside the enclosure was greater than inside. Ataiyan (2002), concluded that the main effects of grazing sites and sampling depth is significant on soil moisture factor and by increasing of grazing intensity, the amount of this factor will be reduce.

Javadi et al. (2004), was investigated the grazing effects on soil parameters in lar summer range and also they studied the soil acidity in three zones, reference, key and critical zone and also examined it in two horizontal from 0-10 cm and 10-30 cm. The results showed that the soil acidity in critical region is higher than the other two districts. Also, there was a significant difference between two horizons for this factor, as well as the PH value was higher in second horizon. Aghasi et al. (2005), showed that because of the enclosure on Kiyasar ranges of Mazndaran, soil EC is increased and PH value is decreased. Kohandel (2005), concluded that the grazing intensities effect on soil moisture is not significant but significant reduction of this variable is observed during the grazing period (59% on July and 56.2% on August). Jalilvand et al. (2006), were studied the grazing effect on the soil chemical properties in Nowshahr Kojour ranges. The results showed that the acidity value is increased by increasing of grazing intensity. David *et al*. (2006), in order to restore of grassland were examined the soil chemical and physical factors in four separate parts of meadow, dry grassland, pasture and entire pasture as reference area. Results showed that soil PH & EC of grasslands were more than reference area and in meadow was generally lower than ranges and pastures. While these factors in dry grasslands are more than meadow, pasture and reference area. Shifang *et al*. (2008), was expressed that under 6 years of enclosure, the moisture of soil was increased as 30% compared to heavy grazing. Heidarian Aghakhani *et al*. (2010), were studied the effect of grazing intensity on vegetation and soil in Sysab Bojnourd ranges and concluded that the soil conductivity value will be decreased by increasing of grazing intensity but soil acidity will be increased. Bagheri *et al*. (2010), were investigated the effects of grazing intensity on soil moisture of Khobr national park and concluded that soil moisture reduction at average heavy grazing site and non grazing was descending and was 16.87 and 25.07, respectively.

In generally, livestock grazing especially heavy grazing could be changing in soil properties. Because of the proper management of range ecosystem requires to aware of altering factors that affecting it, this research aimed to evaluate the grazing intensity effect on some of the physical and chemical properties in Gardaneh Zanbouri Rangeland of Arsanjan.

II. MATERIALS AND METHODS

Description of the study are

Gardaneh Zanbouri Range with area of 2412 acres in Arsanjan city at distance of 17 km east of this city is located between east longitude 53° 23´ to 53° 26´and north latitude 29° 51´ to 29° 54´. This region is mountainous, mound and plain, the maximum height of that is 2280 m of the sea surface and the minimum height is 1640m of the sea surface. Range slope is varies in different parts and its dominant slope is North- South. The average rainfall of zone according to the weather station Arsanjan is 443.5 mm, the average temperature in the warmest month of the year is 34°c and the average temperature in the coldest month of the year is about -2.9°c (Khademolhoseini, 2004; 2010).

Methodology

At first, the area which under different management such as enclosure, moderate grazing and heavy grazing was identified and segregated. Then, soil sampling was carried out. These 3 zones were iconic locations and include of the reference zone that grazing was not carried out there, the key zone which moderate grazing to heavy grazing was applied there and the critical zone where heavy grazing occurred and all of the characteristics such as topography, soil type and rainfall value are similar and they differ from each other only in grazing intensity. Soil sampling was done as a systematic random method from 2 horizons: from 0-15 cm and from 15-30 cm. Five samples were taken in each horizon and totally 30 samples of soil were taken. After sampling, the samples were packed in black plastic bags which insulated to prevent moisture loss, and then were transport to the laboratory for measuring the wet and dry weight. Samples were measured with digital scale accuracy at the same day of arrival and were recorded on special forms. Then the samples were placed inside the container (Tien) for 24 hours at 75 °C in the oven and then re-weighting. After subtracting the container weight, dry weigh were taken. The moisture percentage was calculated based on the dry weight by calculating of the differences between wet and dry weight. The samples were passed through a 2 mm sieve after drying and staving. Measuring of soil electrical conductivity was performed by electrical conductivity apparatus. The PH of saturated soil was defined by PH meter. The percentage of clay, silt and sand (soil texture) was defined by Pipette method (Geand & Bauder, 1986). Data analysis was done by SPSS software. After data analysis and awarding of meaningful averages, the averages comparing was done by Tukey test. Also, if there have not seen any significant difference in F test, comparing of the averages was not carried out.

III. Results

Two-way variance analysis for factors under study is shown in Table 1. By studying of this table we observed that, there is significant difference between the 2 sampling depths at 5% level of humidity factor, electrical conductivity, silt percentage and sand percentage. While, there is not significant differences in soil PH and clay percentage. Also, the different levels of grazing intensity showed significant differences at 5% level in all parameters were examined. Also, there is significant difference at 5% level between 2 factors such as depth and intensity level of grazing in some parameters: electrical conductivity, PH and clay percentage. This means that there is interaction between depth and grazing intensity. This factor is not significant for soil moisture, silt percentage and sand percentage.

Table 1: Two-way analysis of variance for investigated factors

Factor	Changing resource	Depth	Grazing intensity	Depth * Grazing intensity
Humidity	F	17.869	12.809	0.211
	Significant	0.000	0.000	0.812
EC	F	31.360	136.57	116.604
	Significant	0.000	0.000	0.000
PH	F	2.252	10.754	28.490
	Significant	0.146	0.000	0.000
Silt	F	22.400	11.979	0.950
	Significant	0.000	0.000	0.401
Clay	F	4.723	55.687	8.265
	Significant	0.040	0.000	0.002
Sand	F	28.005	18.807	1.828
	Significant	0.000	0.000	0.182

After ensuring that there were significant differences to compare two averages which were related to the grazing levels, the Tukey test was used. The results of the Tukey's method for dividing the averages are given in the Table 2. As seen in Table 2, the soil moisture, electrical conductivity and clay percentage could be seen in three separate groups. This means that there are significant differences in these criterias between three areas.As can be seen in this Table 2, with an increace in grazing intensity, the soil moisture decreased, while electrical conductivity of soil increased. Clay percentage in the medium grazing area is maximum and in the grazing area is minimum. Also, as factors related to acidity, silt percentage, sand percentage can be seen 2 groups. Also, there was not any significant difference between grazing area and heavy grazing for acidity and sand percentage.But there is significant differnce between these two areas and average garzaing area. There was not any significant difference between grazing area and average area but there was a significant difference between these two areas and heavy

grazing area. concerning the depth of the sampling, because there were only 2 depths and, comparisons were made on 3 factors, comparing averages was only carried out in different levels of grazing.

Table 2: The results of Tukey test for homogeneous averages grouping

Factor	Grazing intensity	Subgroups at 5% level		
		1	2	3
Humidity	Heavy	5.8880		
	Moderate		8.3990	
	Grazing			10.9160
	Significant	1.000	1.000	1.000
EC	Grazing	0.4360		
	Moderate		0.5460	
	Heavy			0.5690
	Significant	1.000	1.000	1.000
PH	Grazing	7.6610		
	Heavy	7.6990		
	Moderate		7.7630	
	Significant	0.259	1.000	
Silt	Heavy	30.200		
	Grazing		35.8000	
	Moderate		39.6000	
	Significant	1.000	0.142	
Clay	Grazing	19.9000		
	Heavy		23.3000	
	Moderate			25.4000
	Significant	1.000	1.000	1.000
Sand	Moderate	36.2000		
	Heavy		45.6000	
	Grazing		46.7600	
	Significant	1.000	0.814	

IV. Discussion and Conclusion

The results of the soil moisture study showed that there was a significant difference between the two depths at 5% level of soil moisture. As the moisture content at the depth of 0-15 cm was less than the depth of 15-30 cm. Also, the difference levels of grazing intensity has been shown the significant differences at 5% level. Thus, when we move forward from enclosure zone to the heavy grazing zone, the amount of the soil moisture is reduced. Ozgul & Aztaz (2004), Sheifang *et al.* (2008), Ataiyan (2001), Bagheri *et al.* (2010) and Sheidaii karkaj *et al.* (2013), obtained similar results, too. This subject is primarily due to the loss of vegetation. Heavy grazing with reducing of vegetation caused to the water infiltration in the soil and consequently reducing of soil moisture. On the other hand, increasing of grazing intensity caused to the soil compaction and as result will be reducing of permeability and moisture percentage. Grazing pressure at the long time caused to creating of dense layer at the depth of the soil. This phenomenon is exacerbated by the loss of vegetation. Not only vegetation reduces, exposed the soil to the water and wind strong erosions, but also, its resisted is reduced in front of the stampede and caused to the mechanical strength increasing at the surface layer. This phenomenon has occurred in areas with heavy grazing to prevent germination and early establishment of range plants and later limit the roots expansion and their productions (Chaii chi et al., 2006). Soil moisture at the range ecosystem of arid zone and semi- arid rangeland is a controlling factor which dictates the structure of species, soil process (Li, *et al.*, 2008), vegetation and biogeochemical process (Stavi *et al*., 2008).

The results of the soil EC showed that there is significant difference at 5% level between 2 sampling depths. On the other hand, there is significant difference between three enclosure areas, moderate and severe grazing areas in the soil EC at 5% level. This means that every three areas are different as soil salinity. The way of these changes are different at 2 sampling depths. That is the level of EC in 0-15 cm at the enclosure area is lesser than the moderate grazing area. This area, in turn, EC levels is lesser than intense grazing area. While, at the second depth means 15-30, EC trend is otherwise. At this depth, like as first depth, enclosure zone has the lowest EC, and after that the heavy grazing area is sever and at least, the largest EC at this depth is related to middle grazing zone. By reviewing of alterin process we understand that at both of the survied depth, the enclosure zone has the lowest EC. This is due to the absence of livestock at the enclosure zone and thus not stepping of soil and also because of more vegetation. By reducing of

grazing intensity, vegetation has been increased, evaporation and transpiration is reduced and as result the level of EC is reduced (Kashi Zenoozi *et al*., 2011). On the other hand, by increasing of grazing intensity, in addition of reducing of vegetation and increasing of evaporation and transpiration, the soil stepping is increasing that leads to the soil compaction (John & William, 2000), reducing of soil pores, reducing of permeability, reducing of soil moisture (Eskandari, 1995) and as result soil EC increasing. So far, we forward from enclosure zone to the sever grazing zone, the grazing intensity is increased. So, we expect that the rate of soil EC is increased. Kohandel *et al*. (2010), has found the similar result at the depth of 0-15 cm of soil. Here we observe this process at the depth of 15-30 cm. But at the depth of 0-15 cm the changes can be seen, so that the moderate grazing zone has more EC than intense grazing zone.This can be attributed to the soil texture. By study of these zones' soil texture in the first depth we found that the clay content at the enclosure zone was lesser than the two other zones. The moderate grazing zone was more than the intensive grazing zone. Increase of clay percentage led to natural soil drainage decreases and thus reduction of the leaching amount. This leads to the accumulation of the salts and minerals in the soil and as result it caused to the EC increasing. These results are agreement with Mirza Ali *et al*. (2005).

The results of this study indicate that there is not any significant difference between 2 sampling depths for PH. While there is significant difference at 5% level for grazing intensity of different levels. Thus, there is not any significant diffeence between enclosure zone and under intensive grazing for soil PH and this result is consistent with Menzes *et al*. (2001) results. While there is significant difference as statistical analysis at 5% level between the enclosure zone and under moderate garzing zone. So that, at the both of the depths, the PH range of the grazing zone is lower than the zone under moderate grazing. This could be due to the presence of more organic matter in the enclosure soil. When organic matter is decompossed, both organic acid and inorganic acid are produced which the simplest and the most abundant of them is carbonic acid albeit it is a weak acid, but, its permanent production in the soil which its root density is high causing the dissolved lime and its leaching from the soil. Lime evicting of soil caused to the PH reducing (Clari, 1995). Javadi *et al*. (2004), Aghasi *et al*. (2005) and Sheidaii Karkaj *et al*. (2013), also reached the similar conclusion. Also, there is significant difference between the under heavy grazing zone and moderate grazing with 95 percent for PH levels. As, at the depth of 0-15 cm the amount of that at the area under the heavy grazing is lower than the moderate grazing but at the depth of 15-30cm it has a reverse process and its amount at the heavy grazing zone is much more than moderate grazing zone.

Soil PH is associated with soil free hydrogen ion concentration that creats by chemical reactions of root, water analysis and chemical weathering . Hydrogen ions concentration is detemining of soil PH. The soils with high concentration of hydrogen ions tend to become acidic and thus PH reducing.The area under the heavy grazing, intensive livestock grazing caused to the soil compaction and high stepping. This leads to decreasing of water infiltration to the soil, lack of Oxygen penetration and lack of soil oxygen and non composing of organic matter.The result of these, is soil chemical weathering reducing. On the other hand, because of the reducing of water infiltration to the soil, decmposing of water has not taken place in the absence of water and the combination of these factors caused to reducing of the soil free hydrogen ion amount that this subject can increase the soil PH at the heavy grazing zone as compare to the moderate grazing zone. Also, at the moderate grazing zone, increasing of Co2 due to the respiration root and decomposition of organic matter caused to the decreasing of soil PH (Robbins, 1986 ; Gupta *et al*., 1984). Soil salts can be effective on the soil PH. One of the reasons for PH increasing in this depth is existing of bicarbonate ion which combinated with +03H and absorb the proton. At the modified ionization equilibrium and caused to freed up the OH ions and so, cause to increasing of PH. So, whatever the amount of carbonates is greater, the degree of PH will be greater. By studing of the bicarbonate ions amount at the depth of the 15-30cm, we found that the amount of the bicarbonate at the severe grazing is more than moderate grazing and at the enclosure zone is lesser than moderate grazing zone. So, by considering of these factors, the above result can be justified. Johnson *et al*. (1971), Mousavi (2000), Javadi *et al*. (2004), Jalilvand *et al*. (2006) and Heidarian aghakhani (2010), were achieved to the similar results in their researches.

The results of the soil texture study showed the differences as clay percentage, silt and sand between the all three grazing zones. By study of these changes process despite the differences, could not be obtained the specific relationships between livestock grazing and the percentage of particles.Since the soil texture is one of the steady soil properties that it has been chnaging as rarely and difficulty, It appears to the existed differences in the soil texture is caused by the other factors instead of grazing intensity. Ajami *et al*. (2007), reported that severed losses of organic matter, increasing of silt percentage in soil aggregation, significantly reducing of microbial activity and using of farm machinery are the most important factors in reducing of aggregate stability.He stated that, the organic matter has property of texture modifying in the light and heavy soils. Because of the decomposition of organic matter and soil aggregates disintegrates at the cultivated farms, the finer particles are transported through erosion and coarse particles which remained. Thus, by reducing of the amount of the organic matter the amount of the silt is reduced while the clay amount is added. Deep leaching is enough reason to migrate the clay to the depth of the soil.

ACKNOWLEDGMENTS

This paper was extracted from Payame Noor University research project of Iran. We express our gratitude for cooperation of this university.

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