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Effect of Soil Properties on *Artemisia sieberi* Forage and Growth

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Abstract. Soil factors affect on plant growth which some of them are more important. The goal of this research was to investigate the effects of soil properties in Zarand Zavieh rangelands with 40000 ha (Iran) on growth characteristics of *Artemisia sieberi.* The experiment was conducted on intact soil samples collected from eight area with three plots($15\times15m^2$) which three nested plots ($8\times6m^2$) established in the form of random-systematic in the Zarand Zavieh rangelands (94 km southwest of Karaj, Iran) during the grazing seasons. Some factors such as density, forage, cover, height and diameter of plant were measured. Samples of soil were taken from four in depth, 0-20, 20-40, 40-60 and 60-80 centimeters for determination of physical and chemical soil characteristics. Soil properties such as texture, EC, N, P, K, pH, Ca and TNV were measured. For analyzing of data used SPSS and analysis of PCA, CA, Regression, Compare means, Correlation, Variation. The results of the experiment showed that some growth characters (plant density and cover) were negative significantly affected by potassium and present of silt of soil treatments. Also there is significantly relationship between plant factors such as height, cover, diameter and forage at the 0.01 level. The results show that there is significantly relationship between silt with N and K at the 0.05 level and between silt with P and TNV at the 0.01 level too. Also there is negative significantly relationship between sand with K and C and positive relationship between sand with EC and pH at the 0.01 level. Therefore to improve of rangeland can use this species in all soils with any properties just for heavy K and completely silt soil, due to this situation has been propagated in all of the county(Iran). For determine forage without clipping, according to high correlation between height, cover and diameter of plant can use formula regression.

Keywords: *Artemisia sieberi*, Height, Diameter, Forage, Cover, Physical and Chemical Soil Properties.

1. Introduction

One of the rangeland management factors is recognition of effective factors on these resources. Complete program to best management of rangeland and prevent of degradation need to recognition of rangeland and its plant cover and effective factors on propagation of plant. This will caused high qualities and quantities rangeland production and finally resulted to sustainable and satisfactory utilization (Ghelichnia, 2005). Effective factors on vegetation fall in to major, biotic and abiotic, abiotic factors such as; climatic, edaphic, topography and so on. Effect of climatic, edaphic and topography in different region of Iran to cause growth of plant and it result different rangelands (Moghadam, 1998). Soil procedure is resulting of climatic, mother material, topography, alive existing and time. Plant communities' propagation in regions and its composition depend on soil especial properties. These properties affect on plant cover and life form of plants. In a region with unit climatic properties, plant cover first of all affected by soil texture, depth and other factors (Mesdaghi, 1995). In equal climatic situation, plants on little depth are different from plants in depth. Plant cover in this study is image of plant biomass vertical on soil surface (Sheidaee, 1996). Chemical and physical properties of soil have important and key role to formation of plant and structure of plant

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communities (Bednarek, *et al.,* 2005). In study of plant cover and affected factors on it's, should consider soil properties and topography which there is many research mentioned to important of K, pH in production and cover (Abule, *et al.,* 2007). Results of study of researchers show that propagation of similar plants affected by environmental factors (Bonham, 1989). Plants affect on under soil which cause different morphological and chemical in soils. Morphological and chemical properties are texture, structure, depth, percent of gravel, bulk density, stability and layers of soil and SAR, EC and pH respectively. Therefore it can be said that soil properties and nutrient matter reserves are highly dependent to plant cover (Belsky *et al.,* 1994). Zareii, *et al.,* (2010) in Namak Kooh of Gom province resulted that important properties of soil for division of plant in region are texture, EC, Mg, CL, and Na. Due to especial morphology, the most part of Iranian plateau (approximately 46%) includes dry and semi dry regions which have index species plants such as; Artemisia and Astragalus (Ariavand, 1987). One of the most important genuses of plants in Iran after Astragalus according to cover density and vast propagation is Artemisia form *Compositeae* family with 34 species. The species are more important in terms of adaptation with semi dry and dry region, resistant against cold, life form of shrub and semi ligneous, forage production for wild animal and livestock, using in industrial and medicinal, resistant against heavy grazing, immune of early grazing, easy establishment by natural regeneration or reseedling and its role in soil and water conservation (Bashari *at al.,* 2004; Habibi, 2007; Mozafarian, 1989). Also Artemisia genus have many properties such as; perennial, palatability and forage ratio digestibility ability, loge term of growth period and utilization possibility in winter and autumn seasons and high forage production according to quantities and qualities and also resistant again insect and diseases (Sedeghi, 1992). Mirhaji *et al.,* (2001) explained that propagation and establishment of some species of Artemisia in Semnan province to be touched chemical and physical soil properties. Research of Pourfathi *et al.* (2011) in Halichal of Amol region on *Atremisia fragrans* showed that the most important factors affecting pattern and distribution of plant communities were altitude, pH, K and EC in upper layer of soil. Also they resulted that the cover percentage of *A. fragrans* was variable along the altitudinal gradient and its variability was related to EC and pH of upper soil layer. For improvement of dry ecosystems can use *Artemisia sieberi* which Habibi (2007) investigated effect of soil and topography properties on natural regeneration of this species in Maraveh Tapeh region of Golestan province. The most important effect of climatic factors on propagation of *Artemisia aucheri and Artemisia sieberi* in Esfehan province by using multi analyze methods was investigated by Yaghmaee (2006). Azarnivand (2003) investigated ecological and geobotany of two species of rangeland plant *Artemisia sieberi* and *Artemisia aucheri.* His result showed that properties of plant approximate change under effect of high and region except sytogenic factor. Henteh (1990) indicated effects of *Atriplex canisens* cultivation on soil properties. Khalkhali in 1996 and Naseri in 1997 investigated effects of *Atriplex canisens* planting and environment. Also Naseri (1999) investigated effects ecology of *Atriplex canisens* on under planting fields. Torbatinezhad, *et al.,* 2003 determined and compared value palatability of two species *Artemisia sieberi* and *Artemisia aucheri* in seedling period. Jankju *et al.,* 2011 studied autecology of *Artemisia turanica* in winter rangelands of Northern Khorasan province. They resulted that resistant to salinity of soil and growth in marn, conglomerate, sandy, silty- loam geology age and with weak alkaline with medium saline soils and poor nitrogen and organic matter. The aim of this study is investigation of environmental factors effect (especially soil and its factors) on density, forage, cover and height of *Artemisia sieberi* in Ghete Chahar e Zarand Zavieh of Saveh.

2. Material and Methods

This study conducted to relationship between soil properties and plant factors.

Artemisia sieberi Species: Artemisia genus is form compositae family, perennial, shrub, having many stems and thick, its height between 25 to 50 centimeters and often erect. In flowering and fruity often has without leaf and in before with leaf. Flowers are red or purple. Time of flowering and maturity of fruit is early to last of autumn. It has propagation in most of the country (Rechinger, 1986).

Study Area: The Zarand Zavieh region has an area of approximately 40000 hectares and is located 94 km southwest of Karaj, Iran. The region has been limited to mountain from north and plain from south (Henteh, 2003). Medium annual precipitation is between 250 to 300 millimetres. Over grazing in the region observe because of many villages in the region which have pastoralist job to sheep and animal husbandry. Medium

annual temperature changed between -10 to 40 and at some months temperature decrease under zero. To soil sampling, tried to taking in terms of unity based on soil making. All of the samples were on type of gravel lands. Slope of lands were between 12 to 15 percents and those aspect south. Gravel percent on surface and under surface were 30 to 50 and 50 to 70 percent respectively. Drainage of these soils is fast. Type of soils is Enti-soil in region based on American category with 60 to 100 centimetres depth and without clear horizon. Soil texture often change between light and medium and about 6, 7 and 8 plots soil texture are medium to heavy. Soil surface horizon structure is tiny texture (microlithic) and in under horizon grain. These soils have little erosion to moderate. Mother rock of these soils has been made by Kohfrt and Hard Dolomit.

2.1. Methods

Sampling: This region divided to 4 statistical and sampling sites which one of them divided to two regions such as upward near mountain and downward near plain. Reason of this dividing is because of different soil in each region and also for reliable data collection. Majority of upper soil near mountain are stone and there is more percent of stone and gravel and opposing in down soils are tiny texture (microlithic) like. In each site 3 quadrates with 15×15 m square were and in their $6\times8m^2$ nested plots established. Sampling establishment every plot was randomize-systematic. Sampling was among one year. Plant factors measured such as; height, diameter, forage, density, frequency, abundance, and cover. In order to determination of chemical and physical soil properties samples were taken away to laboratory in each sample plots from 0 to 80 centimeteres which divided to four deep such as; 0-20, 20-40, 40-60 and 60 to 80 centimeteres (Yaghmaei *et al.,* 2008). Majority of researches reported that Artemisia genus and other rangeland shrubs growth with deep infiltration of root to 80 centimeter.

Chemical soil analyzing: In laboratory measured soil texture by Hydrometer Bikes method, pH by saturate of mod and pH meter, Electrical Conductivity (EC) by saturate extract and electrical measuring, Calcium by Titration with EDTA solution and Potassium by Atomic Absorption device, Nitrogen by Kajedal and organic carbon by Walkly-Blach.

Data Statistical Analyzing: Results analyzed by regression analyzed between regions (48 m square plots) and between two region mountain macrolithic and plain microlithic. SPSS and Excel and other needed software used and analyzed by correlation, regression, CA, PCA, ANOVA, cluster, one-way experiment for two region and results (Leps and Smilaur, 2003).

3. Results and Discussion

Results showed that there is positive and significant relationship between diameter and forage at the level of 95% (Fig. 3). Positive relationship was significantly between diameter and cover. Consequently prediction of forage is easy by diameter and cover without clipping and weighting of herbages. Also to management of rangeland and determination of range condition cover parameter will be predictable by diameter. This subject has been mentioned by Sheidaee in 1996.

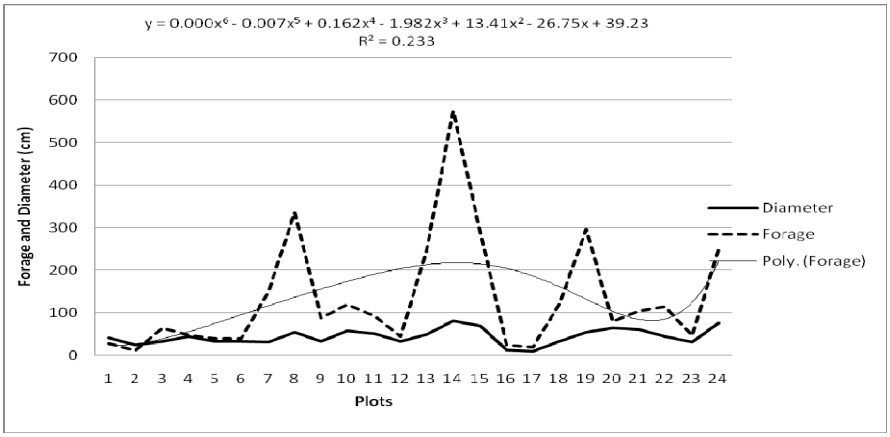

Fig. 3: Relationship between forage and diameter of *Artemisia sieberi*

Clustering analysis on different plot in the case of height factor showed that 8, 13, 15, 19 and 24 plots are in first group and 14 in next (second) and residuals were such as; 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 16, 17, 18,

20, 21, 22 and 23 in third group. This result showed that this plots have alike factors of soil for growing plant (Bednarek, *et al.,* 2005).

Also clustering analysis on different plot in the case of diameter factor showed that 8, 10, 14, 15, 20, 21 and 22 plots are in first group and 3, 7, 11, 13, 19, 23 and 24 in next (second) and residuals were in third group (Fig. 6). This result showed that this plots have alike factors of soil for growing plant (Bonham, 1989; Belsky et al., 1994). 8 and 15 plots are in first group according to height and diameter. This subject show that in this plots soil factors such as chemical and physical are alike.

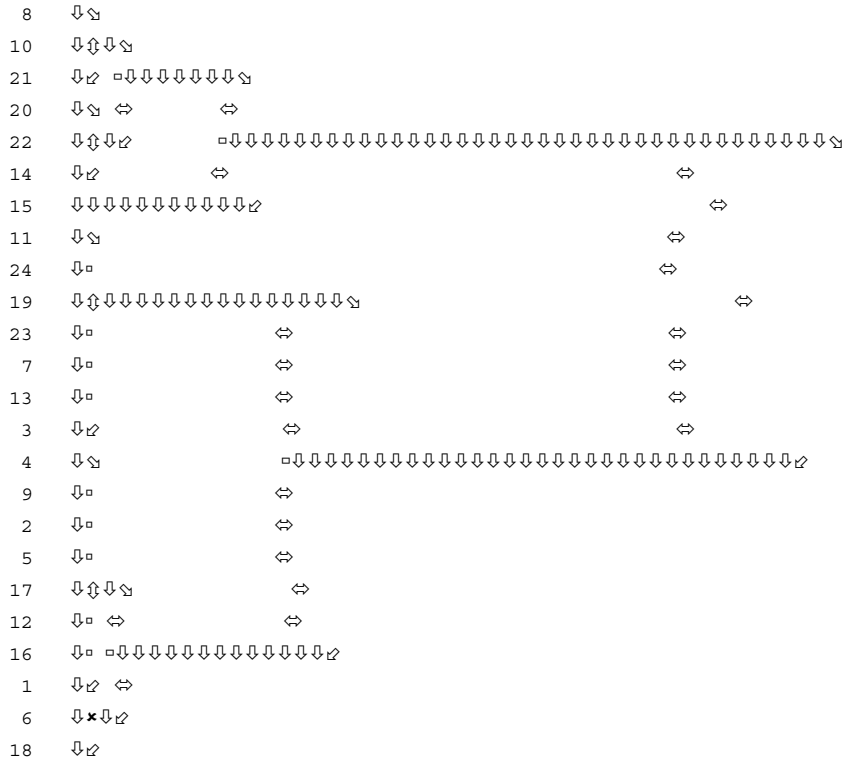

Fig. 6: Clustering analysis in the case of plots similarity in terms of *Artemisia sieberi* diameter

The analysis of correlations between environmental properties showed that there is negative significantly difference between density and phosphorus at the level of 5%, cover and silt. As a result this species is vast propagation in all places in terms of geological and soil properties except phosphorus and silt (Table 1). This result is to confirm research of Ariavand in 1987. This analysis show that there is significantly correlation between N and K with clay, P and TNV with silt, pH with sand and negative significantly correlation between sand with K, Carbon and EC too.

Table 1: The analysis of correlations between environmental properties

Factors	Density	Height	Diameter	Forage	Cover	Clay	Silt	Sand	K	P	N	Carbon	TNV	pH	EC
Density	1	-.097	-.045	.060	-.211	.267	-.078	-.164	.070	-.484(*)	-.020	.297	.037	-.226	.114
Height	-.097	1	.874(**)	.542(**)	.489(*)	-.278	-.010	.282	.012	-.089	-.254	.091	-.280	.136	-.125
Diameter	-.045	.874(**)	1	.729(**)	.695(**)	-.298	-.144	.277	.101	-.103	-.272	.135	-.363	.102	-.058
Forage	.060	.542(**)	.729(**)	1	.580(**)	-.154	-.130	.230	.003	-.147	-.129	.169	-.390	.198	-.120
Cover	-.211	.489(*)	.695(**)	.580(**)	1	-.047	-.411(*)	.037	.070	-.227	-.230	.191	-.335	-.124	.136
Clay	.267	-.278	-.298	-.154	-.047	1	-.164	-.652(**)	.443(*)	-.318	.434(*)	.244	.252	-.130	.393
Silt	-.078	-.010	-.144	-.130	-.411(*)	-.164	1	-.236	.153	.632(**)	-.095	.143	.529(**)	.169	-.001
Sand	-.164	.282	.277	.230	.037	-.652(**)	-.236	1	-.825(**)	-.003	-.251	-.620(**)	-.131	.610(**)	-.873(**)
K	.070	.012	.101	.003	.070	.443(*)	.153	-.825(**)	1	.048	.230	.668(**)	-.103	-.520(**)	.885(**)
P	-.484(*)	-.089	-.103	-.147	-.227	-.318	.632(**)	-.003	.048	1	-.023	-.023	.332	.267	-.077
N	-.020	-.254	-.272	-.129	-.230	.434(*)	-.095	-.251	.230	-.023	1	.231	.183	.055	.173

Carbon	.297	.091	.135	.169	.191	.244	.143	-.620(**)	.668(**)	-.023	.231	1	-.033	-.432(*)	.691(**)
TNV	.037	-.280	-.363	-.390	-.335	.252	.529(**)	-.131	-.103	.332	.183	-.033	1	.327	-.208
pH	-.226	.136	.102	.198	-.124	-.130	.169	.610(**)	-.520(**)	.267	.055	-.432(*)	.327	1	-.796(**)
EC	.114	-.125	-.058	-.120	.136	.393	-.001	-.873(**)	.885(**)	-.077	.173	.691(**)	-.208	-.796(**)	1

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

The analysis of principal component (PCA) show that there is 5 component which in first column place Clay, Sand, K, Carbon, pH and EC, in second Height, Diameter, Forage and Cover, in third Silt and P, fourth just N and fifth Density and N. These results are alike with result of correlation analysis. This result shows that density hasn't positive correlation with nitrogen and other soil properties with TNV (Table 2). Tables of 3 and 4 show summary models of density and forage with soil properties.

Variation analysis shows that there is significant difference between regions in near mountain and plain according to height, diameter and forage, K, C, pH and EC. Also there is significant difference in replicate plain according to height, diameter and forage, and EC (Table 5). Research of Henteh in 2003 accepts these results. Analysis of variation and correlation showed that in two region plant growth different and product forage and cover. So for rangeland grazing management, production of medicinal and industrial plant and wild animal can cultivate and improve by this species which this subject confirm by Bashari *at al.* 2004; Habibi, 2007; and Mozafarian, 1989.

Table 5: The analysis of variance measured characteristic under the influence of different treatments and region.

Factors	df	Mean Square							
		Height(cm)	Diameter(cm)	Forage(gr/m^2)	Density	Cover(%)	Clay(%)	K(p.p.m.)	P(p.p.m.)
Replicate	3	184.501*	710.166*	37300.389*	27.714ns	12.129ns	6.16ns	100.46ns	6.15ns
Region	8	177.4*	665.99*	9769.151*	26ns	4.66ns	21.1ns	140.11*	7.62ns
Error	24	187.32*	767.89*	9965.566*	26.9ns	4.99ns	11.54ns	99.89ns	5.45*
CV (%)		12.3	9.9	13.3	12.1	8.9	13.51	10.88	6.28

* significant at the 0.05 level (2-tailed).
** significant at the 0.01 level (2-tailed).
ns None significant

4. Conclusion

Range improvement for forage production, soil and water conservation, medicinal and industrial plants do by some species which can adaption to any climatic and edaphic changes. *Artemisia sieberi* is one of the species which vast propagation and is native in Iran (Sedeghi, 1992). These results are in contrast to findings of other researchers who indicated that the soil properties effect on plant propagation (Mirhaji *et al.,* 2001). These results could well support the results of this experiment because of all type soil texture and high parameter content in area soil samples. This species can growth in all situation of soil accept amount of N, K except P (Jankju *et al.,* 2011). Research of Pourfathi *et al.* (2011) in Halichal of Amol region on *Atremisia fragrans* showed that the most important factors affecting pattern and distribution of plant communities were altitude, pH, K and EC in upper layer of soil, which this research confirm its results. *Artemisia seiberi* graze in autumn because after autumn rainfall essential oil on leaf of plants will be less and livestock can graze (Torbatinezhad, *et al.,* 2003). Cover of this species dominant in semi arid land and arid land in center of Iran which is the best for soil and water conservation (Ariavand, 1987). Soil properties due to plants effects is not the determining factor to explain the less bio-mass and growth performance of high quality plant species in sites. In such a condition climatic factors as well as some edaphic conditions (texture, N, P, K, EC, pH, TNV and C) play a significant role in vegetation growth and establishment and production in rangelands.

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