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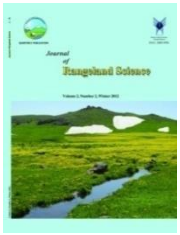

Short Paper Article:

Determination of Soil Salinity in *Frankenia hirsuta* L. Habitat (Case Study: Saline and Alkaline Rangelands of Golestan Province)

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Abstract. Soil salinity is one of the important factors which can influence the growth and distribution of plant species. Saline and alkaline rangelands of Golestan Province, Iran with low-deep underground water level are considered as a halophyte plant species growing area. Attempts have been made to determine soil salinity and its relationship with *Frankenia hirsuta* L. In order to determine the Electrical Conductivity (EC) of soil, three soil samples had been taken in the flowering stage of *Frankenia hirsuta* from the soil at depth of 0-30 cm in three undergrazing, exclosure and control areas (where there was no *Frankenia hirsuta*). Data were collected and analyzed for soil Electrical Conductivity (EC). Results showed that there was a significant difference ($P \leq 0.01$) among three sampling areas (exclosure, undergrazing and control). High EC values were obtained for control area. So, the presence of this species in saline and alkaline rangelands was highly affected by soil salinity. Soil salinity in the control area was 39% higher than undergrazing area.

Key words: *Frankenia hirsuta*, Golestan Province, Rangelands, Saline and alkaline, Alinity.

Introduction

Soil factors play important roles in the distribution of plant species, development and sustainability of rangeland ecosystems and finally have a significant effect on the management of these areas (Taghipour *et al.*, 2008 and Jafari *et al.*, 2006). Salinity of soil as an effective factor has a significant role in the plant distributions which have made some problems in the agricultural activities (Jafari, 1990).

Saline and alkaline soils have occupied a wide level of the world so that the area of saline soils has been estimated about 260 to 340 m ha. The extent of various soil types in Iran is estimated around 25 m ha (Zehtabian & Sarabian, 2004) regarding that saline and alkaline soils cover 12.5% of the whole areas of the country (Akhani and Ghorbanli, 1993). Most of rangeland areas in Golestan province (167000 ha) are located in the east part of Caspian Sea which has been affected by salinity and alkalinity of soils (Hosseini, 2004).

The greatest degree of saltiness tension is formed as a result of sodium chloride, especially of NaC1 type in the natural environment (Fitter and Hay, 1987).

Regarding the large amount of salinity of soils in such area, information of plants, soil salinity and interaction between them are necessary elements for range management. Therefore, in order to determine the distribution of halophyte plants and its relationship with soil salinity, this research was conducted in three areas of *Frankenia hirsuta* L. habitat.

Materials and Methods

The saline and alkaline rangelands in Golestan Province are the regions that contain saline soil with low deep underground water level. This area is one of the winter rangelands located in the desert with low-lying lands. The rainfall of study area is 238 mm with a semi-arid climate and the mean annual temperature is 17.7 ºC. It has saline and silty-loam soils covered with halophyte species such as *Halocnemum strobilaceum, Frankenia hirsuta, Aeluropus lagopoides, Aeluropus littoralis, Halostachys caspica, Salsola turcomanica,* etc. (Hosseini, 2010). *Frankenia hirsuta* that is a perennial plant from the Frankeniaceae family (Mozaffarian, 2005; Amirabadi Zadeh, 1995) had been selected for this study.

Research Methods

In order to determine the amount of soil Electrical Conductivity (EC), three sample sites (undergrazing, exclosure and control (without *Frankenia hirsuta* L.) were selected. The soil samples had been taken in the flowering stage of *Frankenia hirsuta* from the soil at depth of 0-30 cm and then Electrical Conductivity (EC) was estimated. A completely randomized design was used with three treatments (including undergrazing livestock, exclosure and control areas) and four replications. The collected data were analyzed using SPSS software.

Results

The results of variance analysis and mean comparison of soil Electrical Conductivity (EC) are shown in (Tables 1 and 2), respectively. The results showed a significant difference ($P \leq 0.01$) among treatments (Table 1). Results of mean comparison for EC using Duncan method in three sampling areas (exclosure, undergrazing and control) are shown in (Table 2). The high values of soil salinity were obtained for control area and it had significant differences with two other treatments. There was no significant difference between undergrazing and exclosure areas.

The average electrical conductivity of soils was obtained in the areas of exclosure (23 dS/m), undergrazing (28 dS/m) and control (46.1 dS/m) (Table 3).

So, the presence of this species in saline and alkaline rangelands of Golestan province was affected by soil salinity. Soil salinity in the control area was 39% higher than undergrazing area (Fig. 1).

Table 1. Variance analysis of soil Electrical Conductivity (EC) in saline and alkaline rangelands of Golestan Province

Source of Variation	DF	SS	MS	F	Sig.
Between Groups	2	1179	589.5	22.1	0.000**
Within Groups	9	239	26.65	-	-
Total	11	1418	-	-	-

** significant difference at 1% level.

Table 2. Results of comparison of mean soil Electrical Conductivity (EC) in exclosure, undergrazing and control area in saline and alkaline rangelands of Golestan Province

Sampling Area	Soil Electrical Conductivity (EC)
Undergrazing	28.07 b
Exclosure	23.00 b
Control	46.10 a

The means followed with the same letter had no significant difference based on DMRT test.

Discussion and Conclusions

Frankenia hirsuta L. in saline and alkaline rangelands of Golestan Province is highly affected by soil salinity being in accordance with the results for other plant species reported by Brereton (1971), Ungar (1974), Carnoval and Torres (1990), Asri (1993), Hoveizeh (1997) and Zehtabian *et al.*, (2010). The amount of salinity in control area was estimated up to 46 dS/m. While the salinity in the area under coverage of *Frankenia hirsuta* L. was 23 to 28 dS/m. In the area with more salinity (more than 28 dS/m), *Halocnemum strobilaceum* M. B was the dominant species. *Frankenia hirsuta* L. is usually grown as patch form in low parts and water intake of this rangelands. The highest seed germination and plant growth had been reported by Sheidaie and Seraj (1986), Abu-Ziada (1980), Zahran *et al.*, (1996) and Jafari *et al.*, (2002) in such area conditions. Therefore, for the range management, improvement and development of such area, seed spraying in patch form with higher moisture has been suggested.

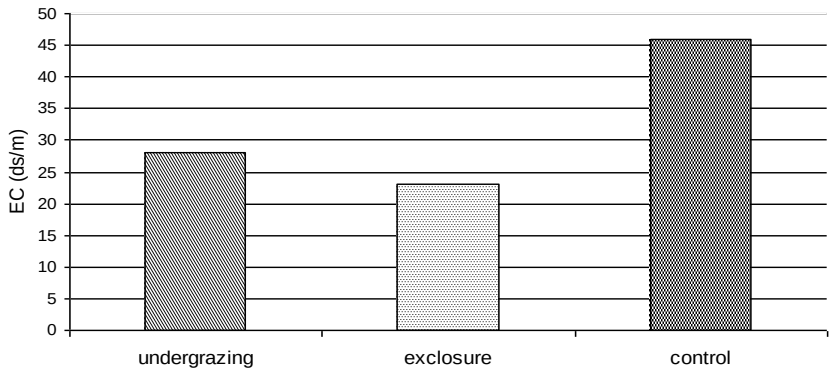

Fig. 1. The soil EC comparison among three treatments (exclosure, under grazing and control)

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