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Research article

THE BIOFERTILISATION OF SALINE SOIL BY PHYTOREMEDIATION METHOD ATRIPLEX (HALIMUS, NUMMULARIA) IN IMPROVING THE PHYSICAL AND CHEMICAL PROPERTIES

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ABSTRACT: This work aims to study the use of Atriplex nummularia and Atriplex halimus and in improving the physical and chemical properties of saline soil. The experiment was conducted under greenhouse and involves the application of 5 doses of NaCl (75, 150, 300, 600 Mm) used soil samples were analyzed in the laboratory after 2 months of treatment.

The results show that the increase in the values of certain physicochemical parameters such as their EC, moisture, Na+ and K+ of the ground with the increase in the NaCl amounts, at the same time to announce the reduction in recorded total porosity appearing of both Atriplex Montre that at A.nummularia, the results obtained on the measured characteristics made it possible to note that the increase in the amounts of salinity caused the rise in the moisture and content of K+ of the ground, on the other hand we recorded a reduction in porosity at the same time, of THIS and of content of Na+ of the grounds on the other hand A.halimus, one notes an important effect on the increase of porosity, the EC and the content of Na+ of the ground and with a reduction in moisture and the content of K+.

The species of Atriplex nummularia is characterized by an improving effect, soil characteristics (EC, pH, porosity and soil moisture).

Key words: Rehabilitation, Atriplex halimus, Atriplex nummularia, Soil salinity, properties physical and chemical soil.

INTRODUCTION

Salinization is a major problem across the globe. According to FAO and the most recent estimates, it already affects at least 400 million ha and seriously threatens an area equivalent. Saline soils, which contain or have contained the early stages of their evolution excess soluble salts, is the main problem of development and the High Plains where they form large veneers around chotts. These are mostly solontchak where sodium chlorides are in

amounts such that the natural vegetation of the area gives way to a salt-tolerant vegetation disappears itself when the proportion of salts increases too [1]. The judicious use of planting woody species contributing both to increasing the production and protection of soil against erosion.[2]

The introduction of forage species, often exotic (Opuntia genres, Atriplex and Acacia), plantations single species, has generally been preferred to the reintroduction of native species. [3]

The benefits of using these species, especially Atriplex, lie in their strategies of ecophysiological adaptations, their resistance to drought and salinity. [4], their highly branched root systems play an important role in the rehabilitation of degraded soils, the fight against soil erosion and desertification. [5]

The technique has several advantages of financial and social natures, or out of matter is less expensive than that having recourse to the traditional and traditional techniques such as the incineration or the scrubbing of the grounds. [6], The aim of our work is to study the effect of culture of two species of Atriplex (halimus and nummularia) on the physical characteristics of soils and chemiques different doses of salt and for their rehabilitation.

MATERIALS AND METHODS

Plant material used

The two varieties used in this experiment it

Figure 1: Atriplex Halimus

Local

Figure 2: Atriplex nummularia

Introduced

2-2- Ecological and cultural

150 1000 mm precipitation between
Zone: Arid, semi-arid
Soil: marly and silty compact deep

3-3- Place and conduct experiments

The test was conducted in a glass greenhouse in plastic pots with a volume of 12,000 ml. Date sown in 22 May 2010. Date of application of NaCl 21 February 2011. 5 doses applied in NaCl (0. 75. 150. 300.600).

Table 1: Baseline characteristics of the studied soil (Control)

Characteristic	**Composition**	**Methods**
Electrical Conductivity (EC) TDS	102.36 µs /cm 31.66 g/l	Conductivity Drying
Limestone total Limestone active	22.44 % 0.83 %	titration method Galet-Drouineau
Organic carbon Organic matter	5.48 % 10.04 %	Anne in Bouneau et al (1994) [7] M.O = C % . 1.72
*Na^+ * K^+	316.23 (ppm) 4.2 (ppm)	flame photometer flame photometer
*P_2O_5	82.46 ppm	Joret-Herbert
*PH * Humidity hygroscopic * Porosity	6.29 1.25 % 44.08 %	PH meter Drying apparent and real densitie

The parameters studied the samples analyzed in the laboratory was carried out after two months from the date of application of NaCl,

The physical properties
Porosity, Humidity

Chemical properties
Electrical Conductivity (EC)
Soluble cations K+ and Na+
Statistical study data

The device is complete random (DAC) with 2 factors studied: two genotypes (Atriplex nummularia and Atriplex halimus) and 4+ control saline treatments (repeated three times). Averages of the variables measured on different distributions were subjected to analysis of variance two classification criteria, using the software (STATISTICXL 2007) A matrix of correlations between the measured variables was calculated.

RESULTS AND DISCUSSIONS

Effect of Atriplex on the physical properties of soil salt

Effect on Porosity

The study of the average porosity of the soil indicates that this parameter decreased with increasing salinity in both species. Except for doses D1, D3 32.42 and 23.83) that are slightly higher compared to D0 and D2 doses (30.68, 22.11) to A. nummularia all results of the average porosity of A. halimus are higher than A. nummularia (D0, D1, D2, D3, D4) respectively to (43.88,33.93,,27.34, 20.11 and 18.57 %), the witness mark of an average total porosity (44.58 %) compared to the lower doses.

Planting without soil is very porous and the increase of NaCl causes a decrease in the porosity especially for doses (D0, D1, D2, D3), sodium is responsible for the clay dispersion, which clog the void volume and makes it impermeable soils , planting of Atriplex causes a decrease in soil porosity especially Atriplex nummularia. So in general, soil porosity decreases by Atriplex planted in the ground without planting, this is certainly due to more developed root system that could affect soil aggregates by compressing empty.

Effect of moisture

The comparison of the average indicates an increase moisture with increasing salinity for doses D0, D1, D2, D4 (1.27, 1.55, 1.76, 1.89%) except for the dose D3, which recorded a decrease in A. halimus and witness with 1.25%. The same remarks apply to A. nummularia content which increased with increasing moisture doses D0, D1, D2, D4 for 1.00, 1.76, 2.52, 2.67% respectively unless D3 slightly lower compared with 1.82% in D2.

This result confirms the effect of saline soils that can remain wet even in dry season due to their richness in minerals hygroscopic. The water holding capacity decreases as a function of the nature of the cations, in the following order Na +> Mg + +> Ca + +> K + [7]. Soil moisture planted with A. nummularia is higher than A. halimus by the accumulation of salt in the latter species is higher.

The decrease in soil moisture planted by A. nummularia at the D3 may be due to morphological polymorphism important for the species involved in the production of biomass [8].

Effect of Atriplex on the chemical properties of soil salt

Effect on electrical conductivity (EC)

The electrical conductivity (EC) of the soil increases with the increase of the salt concentration in both species. For A. halimus dose D0 this with a low average (125.4 µs / cm) compared with doses D1, D2, D3, D4 are (454.97, 628.33, 1145.88, 1495.66 µs / cm).

For A. nummularia is the same remark as for A. halimus, there is an increase of the EC with increasing dose concentration of D0 (83.88) D1 (228.1) D2 (495.66) D3 (808.22) and D4 dose (1352.22 µs / cm). The average EC for the control (102.36 µs / cm) is low. All doses in A. halimus are high compared with the doses of A. nummularia.

The EC values obtained with increasing NaCl concentration in the soil [9] The electrical conductivity of a soil solution is an important index of the contents of soluble salts in the soil.The electrical conductivity of soil planted with Atriplex nummularia is low to the ground and planted with Atriplex halimus ground without planting. The accumulation of NaCl in A. nummularia is high relative A. halimus by the accumulation of salts in Atriplex occurs mainly in the leaves. Halophytes transport and accumulate large amounts of Na + in their leaves, and leaf area of A. nummularia (2.5 to 5 cm long and 2-5 cm wide) than A. halimus (0.5 to 1 cm wide and 4-6 cm in length) [10].

Effect of Atriplex on the Na + content soluble

The mean Na + ground indicate that this parameter is higher with increasing salinity in both species. However outside the D4 dose in both species, there was a soluble Na + content at the most important witness, this demonstrates that absorbs Atriplex Element contributing significant amounts to the extraction of soil and therefore contributes to the desalination of the soil.

Na + in the soil planted with Atriplex halimus high from the ground planted with Atriplex nummularia, because it accumulates more salt, this is the effect of morphological polymorphism [11].

Effect on the content of soluble K +

The high content of K + in the soil is related to the increased salinity in A. nummularia and content of the two lowest doses D0 and D1 with 2.4 ppm. For A. halimus there is a disturbance in the evolution of soil K + with

increasing doses. The highest values are recorded for D1 and D4 with 10.8 ppm.Le witness and the dose of A D0. Halimus is the same value (4.2 ppm).

The increase in NaCl logically furthers an increase of Na + in the soil, against the K + decreases demotion in soil with increasing salt, there is competition and excess Na + reduced the availability of K + [12].Statistical study data

The device is complete random (DAC) with 2 factors studied: two genotypes (Atriplex nummularia and Atriplex halimus) and 4 + control saline treatments (repeated three times). Averages of the variables measured on different distributions were subjected to analysis of variance two classification criteria, using the software (STATISTICXL 2007) A matrix of correlations between the measured variables was calculated.

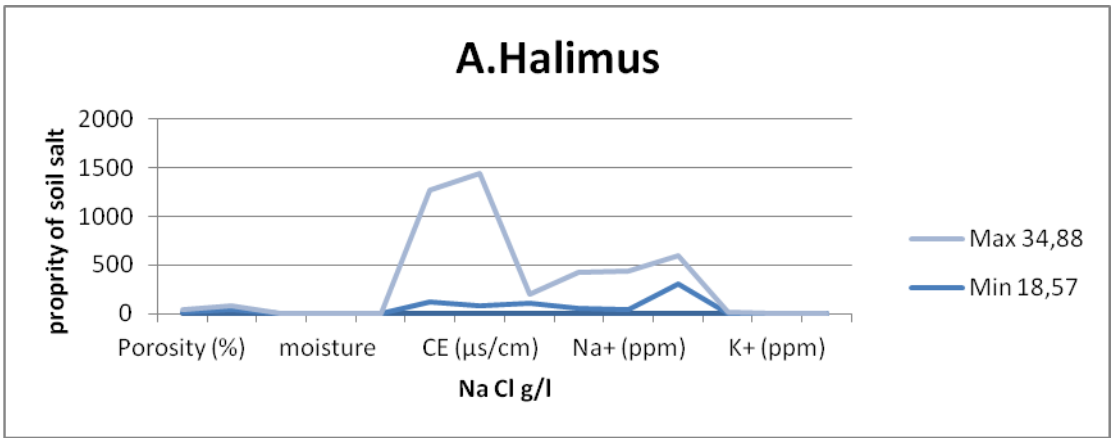

Figure 1a: Effect of planting Atriplex halimus dysiques improvement on physical and chemical properties saline soil.

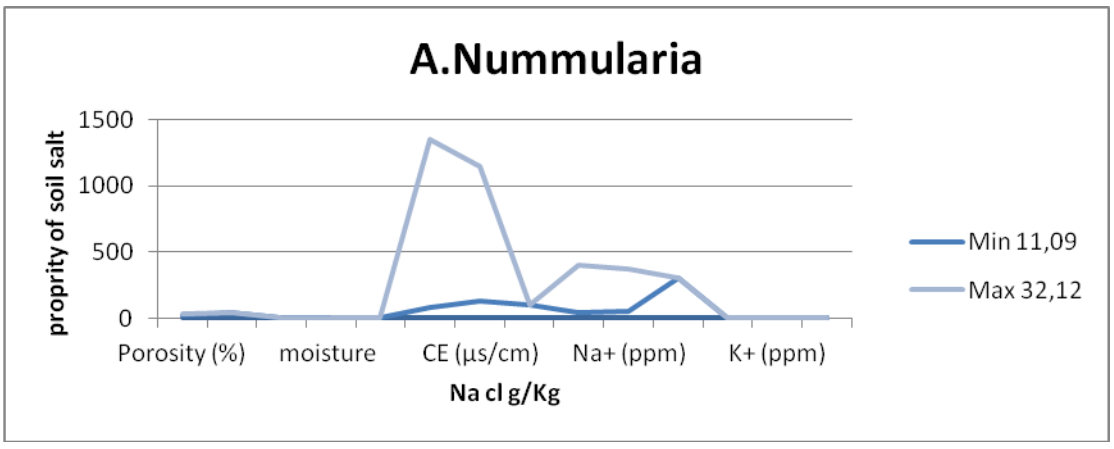

Figure 2a: Effect of planting Atriplex halimus dysiques improvement on physical and chemical properties saline soil.

Table 2: **Results of the physical property of soil saline**

		Porosity (%)			**Moisture**	
	AHalimus	A Nummular	Witness	A Halimus	A Nummular	Witness
Min	18,57	11,09	44,08	1,27	1	1,82
Max	34,88	32,12	44,08	1,89	2,67	1,82

Table 3: **Results of soil chemical property saline**

		(CE)µs/cm	
	A Halimus	A Nummular	Witness
Min	125,4	83,88	102,36
Max	1145,88	1352,22	102,36

Table 3a: **Results of soil chemical property saline**

		Na+ ppm			**K+ ppm**	
	A Halimus	A Nummula	Witness	A Halimus	A Nummula	Witness
Min	51,2	41,11	300,24	3,92	2,45	4,21
Max	368,09	400,01	300,24	8,12	5,28	4,21

CONCLUSION

The experimental study of this research work was conducted under glasshouse at the University Centre Tébessa main objective was to assess the use of halophyte species Atriplex is in improving the properties saline soils. The study allowed us to test the behavior of two species of Atriplex (A.halimus, A. Nummularia) vis-à-vis five doses of NaCl.

The results of the measured variables we have found that as and as doses of NaCl increased the valuesof some physic-chemical parameters such as EC there are also evolving in the same direction.

Knowing the influence of the contribution of soluble salts on the EC of the soil, we consider the values to be quite normal for a sodisation process, that is to say, a soil saturation Na +. It is the same for moisture. As some salt such as Na + are called hygroscopic, ie, they are able to attract and be surrounded by water molecules.

On the dynamics of soluble salts, the study of Na + and K + showed a decrease in these elements of the soil solution, which shows that there has been absorption and therefore extraction of soluble salts from the soil that is materialized by one desalination thus improving soil properties,.

The experiment conducted in not expected effects on the parameters. Should perhaps note the decrease of the total porosity recorded.

The comparative study of the effect of two Atriplex on soil properties. Shows that in A.nummularia, the results of the measured characteristics showed that increasing doses of salinity caused the elevation of moisture content and K + soil, we recorded against the same time decreased porosity, EC and Na + content of soils against A.halimus, there is a significant effect on the increase of porosity, the EC and Na + content of the soil and with decreasing humidity, the content of K+

Concerning the accumulation of mineral elements in plants, we note that the amount of Na + is higher in A. in A. nummularia halimus, the contents of K + are almost identical in the two species.

Definitely, we note that A.nummularia can improve several characteristics of saline soils in relation to A. halimus; however the study shows that the latter species is more resistant to high salinities and therefore more resilient in these environments.

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