USING OF HALOPHYTES SALT CCUMILATING CAPACITY IN STRUGGLE WITH SOIL SALINIZATION

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ABSTRACT:

This article presents the results of experiments conducted to study the nature of the absorption of salts in the soil of certain species of halophyte plants and the possibility of their use in struggling with soil salinity.

KEY WORDS: halophytes, soil, soil layers, salinity, saline soils, saline flushing, salt assimilation capacities, groundwater, plant, agricultural crops, yield.

INTRODUCTION:

In arid zones with insufficient precipitation salts are not washed out in the underlying layers and can accrue on its surface. In depressions, lowlands readily soluble salts accrue not only in the upper layers of the soil, , but also in subsoil groundwater. Therefore, a significant excess and difficulty above ground and groundwater runoff is the main cause of soil salinization. Thereby, the soil salinization is most widespread in semi-desert and desert areas. It should be noted that soil salinization in irrigation zones of Uzbekistan brings great damage to agricultural production.

Drying of the Aral Sea catastrophically enhances soil salinization in the region. From the drained bottom of the Aral Sea, annually 100 million tons of salts rise into the atmosphere, and they spread in 400 km radius. (Umarov, 2000).

Salinity increase is the main reason for yield reduction of agricultural crops. Therby, saline soils melioration, by flushing them in order to remove excess of readily soluble salts, has been and remains as the main and most radical means of successful engagement of these soils in crops.

However, on reclaimed lands, in the root layer of the soil remains the negative effect of salts. It is generally accepted that if the salt content exceeds 0.5% (from soil weight), sowing crops is impractical: such soil is considered highly saline. Medium-saline soils, having 0.2-0.5% of salt concentration, are used in agriculture, but usually with this salinization they give a low yield. With 0.1-0.2% of salt content, it is quite possible the growth of all field crops: such soils are non-saline soils.

As noted above, the most effective way to struggle with soil salinization in irrigated agriculture is a soil flushing which requires a huge amount of fresh water, labor costs and energy resources. As for the desert areas, soil flushing is excluded here and search for methods of struggle with soil salinization is very relevant.

What is the harmfulness of soil salinization in desert and semi-desert areas? The fact is that there are serai processes in these areas, i.e. land cover change will be aimed at halophytization, as a result, the quality of pasture feed, the season of their use is reduced, in a word, occurs a deterioration of economic value of pasture lands.

In this regard, the development of effective methods of struggle with soil salinization is a very urgent task in the region.

Analysis of literary sources on halophytic plant growing in Uzbekistan and abroad indicates that at present halophytes are mainly used as phytomeliorants to increase pasture productivity of saline lands and intensification of feed production (Abrol J.P1986, Abdul - Halim R.K. etc., 1986; Akbarlou M., Moktari Asl A. 2005; Beadle N. C. W. 1952; Carlos Ramirez Ayala M.C. 1988; Mekell C.M. Gooding J.R. Jefferies R. 1986 ; Ortiz-Olguim M. 1988; Pasternak D. etc. 1986; Forte M. 1986; Runciman H V. 1986).

However, there are practically no works on use of halophytes in the bio-reclamation of saline soils, i.e. their salting. In this paper, salt accumulating capacity of some halophytes species was estimated for the first time, in order to use them in struggle against soil salinity.

In this regard, the aim of our research was to assess the salt-accumulating capacity of some halophyte species and to identify perspective species for soil salinization.

The research objectives were:

- Determination of salinity level in the fields where fodder halophytes are grown;
- Determination of halophytes phytomass yield;
- Determination of ash substances in halophytes feed mass;
- Determination of halophytes eatability and nutritional value ;
- Optimal sowing dates determination of , seeding depth and halophyte seedsrates;
- Assessment of halophytes bio-desolation ability in vegetation experiments;
- Development of recommendations on the bio-melioration of saline soils of desert and semi-desert areas.

BRIEF RESEARCH METHODOLOGY:

The objects of research were saline soils of pastures of "Madaniyat" farm company, in Kanimekh district of Navoi region and fodder halophytes: Kochia whisk (Kochia scoparia), scratchy Climacoptera (Climacoptera lanata), Atriplex nitens and high vault (Suaeda altissima).

The degree of soil salinity was determined in the experimental plots, where fodder halophytes were grown. To control the soil samples were taken in a natural pasture. The level of soil salinity was defined by determination of water extract soil solids. (Grechin, Kaurichev, Nikolsky, Popov, Poddubny, 1964). The essence of the method is as follows:

1. Take 50 ml of water extract with a pipette and move to a small porcelain pre-dried and weighed on an analytical scales cup;
2. Evaporate the taken volume of an extract to dryness in a water bath;
3. After evaporation, wipe the cup from the outside and then dry in an oven at a temperature of 105^0C for 3 hours;
4. Chilled cup with residue in desiccator weigh on an analytical scales;
5. Calculate the dry residue (in %):

$$A = a \times 10;$$

where: **A** is the dry residue (in%);

a is the resulting solid weight (in g) in 50 ml. in water extract;

10 is a conversion factor per 100 g of soil.

In vegetation experiments, the level of soil salinity was also determined by the above method before and after halophyte cultivation. Ash substances were determined by burning the plant mass in a muffle furnace at a temperature of 550^0C.

In order to select the salt-accumulating species of halophytes, we conducted vegetation experiments involving such halophyte species as, Climacoptera lanata, Kochia scoparia, Atriplex nitens, Suaeda altisima. All types of these plants are related to fodder plant species. In the experiments, each species of plant was grown in four vegetation vessels.

Total vegetation vessels are 16. Before sowing seeds, the level of soil salinity was determined in all variants of the experiment. At the end of the vegetation period of plants, the level of soil salinity was re-determined in all vegetation vessels, the results of which are presented in table 1.

Table 1.

Soil salinity level before and after the completion of vegetation experiments, in %,

Type of plant	Soil salinity before cultivation	Soil salinity after cultivation	salinity reduction %
Climacoptera lanata	0,96	0,79	-0,17
Kochia scoparia	0,62	0,66	+0,04
Atriplex Nitens	0,67	0,70	+0,03
Suaeda altissima	0,45	0,58	+0,13

The table shows that the environment of the tested plant species, only Climacoptera lanata, contributed to the improvement of soil salinity. If we take into account that the dense residue in the soil is more than 0.3%, then this soil is highly saline. In our case, the level of soil salinity after growing Climacoptera lanata decreased by 0.17%, which indicates the salt-accumulating ability of this plant. The tendency of a certain increase in the level of soil salinity in other experimental variants, in our opinion, is associated with watering during the plants vegetation period.

It should be noted that the reduction level of soil salinity also depends on the plants phytomass. In nature and in crops, the phytomass value of Climacoptera lanata is usually 15-35 c /ha of air-dry mass (Yusupov, Rabbimov etc., 2009). The average weight of one plant varies in large ranges from 1.5 to 5 or more kg. And in the vegetation vessels, the average mass of one plant ranged from 12.6 to 16.2 g. Obviously, this is due to plant growth isolation conditions in the vegetation vessels. However, even under these conditions, all halophytes types went through a complete development cycle and formed seeds.

Thus, the results of vegetation experiments indicate that among the tested halophyte species, Climacoptera lanata is able to reduce soil salinity due to its salt-accumulating ability. In this regard, it can be assumed that this plant cultivation on saline soils can significantly reduce the salinity level. By its biological characteristics, Climacoptera lanata belongs to the group of eugalophytes, Kochia scoparia to glycogalophytes, Atriplex Nitens and Suaeda altissima to crynogalophytes.

THE RESULTS OF STUDYING THE LEVEL OF SOIL SALINITY IN THE FIELD:

Seasonal salinity levels were studied in the experimental plots where Climacoptera lanata was grown. For control, we used soil samples from a natural field, which was located next to the experimental plots, at a distance of 10 m. In the control field, natural vegetation is represented by camel thorn (Alhage psedalhadi), in some places coastal salt marsh (Aegilopis litoralis), Caspian Karelia (Karelinia caspica) and others are also found.

The results of determining the dense residue in a meter soil layer in the control variant with natural grass stand showed that in the upper (0-20 cm) soil layer in the spring the content of the solid residue was 0.51%, in the 20-40 cm layer it was 1.16% , as it deepens, the salt content gradually decreases to 0.53%. In summer, the level of soil salinity in all studied layers increases sharply and in different layers the content of dense residue was 1.34-1.65% (table 2.).

Table 2.
Soil salinity dynamics in the control farm, in %

Soil layer, in cm.	Seasons of the year		
	Spring	Summer	Autumn
0-20	0,51 ± 0,01	1,34 ± 0,04	0,33 ± 0,01
20-40	1,16 ± 0,02	1,53 ±0,02	0,54 ± 0,03
40-60	1,09 ± 0,01	1,65 ± 0,14	0,61 ± 0,02
60-80	0,48 ± 0,02	1,63 ± 0,03	0,58 ± 0,03
80-100	0,53 ± 0,02	1,50 ± 0,01	0,51 ± 0,01

In autumn, there is a sharp decrease in salinity level in all studied layers, while the smallest value (0.33%) is recorded on a layer of 0-20 cm, the largest in a layer of 40-60 cm (0.61%). Thus, the water-soluble salts migration in different layers is closely related to the soil water regime, an increase in salinity in all studied soil layers is associated with groundwater intensive evaporation in the hottest time of the year, in summer. The salinity level study in the plots where Climacoptera lanata was grown showed that in different soil layers in spring the content of solid residue was 0.52-0.67%, in summer this indicator was 1.12-1.61%, and in autumn - 0, 30-0.50%, i.e. in autumn, a marked decrease in salinity is observed in all studied soil layers (table 3.).

Table 3.Soil salinity dynamics in experimental plots, in %

Soil layer, in cm.	Seasons of the year		
	Spring	Summer	Autumn
0-20	0,52 ± 0,06	1,33 ± 0,11	0,36 ± 0,01
20-40	0,56 ± 0,12	1,61 ± 0,24	0, 42 ± 0,02
40-60	0,52 ± 0,03	1, 56 ± 0,13	0,39 ± 0,04
60-80	0,64 ± 0,08	1,12 ± 0,16	0,30 ± 0,03
80-100	0,67 ± 0,18	1,19 ± 0,35	0,50 ± 0,05

Obviously, this is due to the maximum accumulation of phytomass. Analyzing the results obtained in the field experiments, we can say that Climacoptera lanata contributes to a significant decrease in the level of soil salinity in the soil root layer, i.e. due to its biological characteristics, it has the ability to accumulate water-soluble salts on its body.

It should be noted that the depth of groundwater in the experimental plot is about 2 meters, which is a constant migration of salts along the upper layer horizons. Therefore, in order to more reliably confirm the desalinization ability of Climacoptera lanata, we studied the dynamics of the soil salinity level in vegetation experiments. In four vegetation vessels, this plant was grown, in which the soil salinity level was determined before and after plant growth (table 4.).

Table 4.Soil salinity level in vegetation vessels, in %

Soil layer, cm.	Initial salinity of soil salinization, %	Soil salinity during completion
0-20	0,55 ± 0,03	0,49 ± 0,01
20-40	0,74 ± 0,06	0,53 ± 0,03
40-60	0,45 ± 0,02	0,21 ± 0,05

From the data in the table it is evident that there are some decreasing of soil salinity level in all layers. If the upper layer (0-20sm) of the soil firstly was 0,55%, but after the soil salinity level vegetation period it showed 0,49%, i.e. it decreases to 0.06%. While on 20-40sm layer salinity level decreases to 0.21%, but on the 40-60sm layer to 0,21%. Findings points that Climacoptera lanata has biomeliorative capacity of soil salinity. It is due to fact that this plan can accumulate the salt in organism. It is evident that in fruitage period this plant has a great deal of mineral salts, even to 52% (Gaevskaya, 1971). The phytomass yield of this plant according to the soil-climatic level of different ages is from 15 to 45 c/ ha of

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air-dry weight. This demonstrates that Climacoptera lanata growth (pic. 1) from every hectare with plant mass can stand up from 7,5 to 22,5 centner of mineral salts. There are no other methods of salt extract from the soil.

Pic.-1. Climacoptera lanata

In this regard, the plant Climacoptera lanata must find its place in the crop rotation system in agricultural production on saline soils.

AGROTECHNICAL FEATURES OF GROWING CLIMACTOPIA WOOLLY:

Terms of sowing. The optimal sowing period for Climacoptera lanata is the winter (February) month, which allows you to get friendly seedlings due to atmospheric precipitation.

Depth of seeding. The optimal seeding depth of climactopter seeds is 2-3 cm.

Seeding rates. To obtain the required density of grass stand, the following seeding rates of climactopteria are recommended - 10-13 kg / ha.

Harvest timing. The best harvesting period for Climacoptera lanata is the phase of full ripeness of seeds.

CONCLUSION:

1. Eugalophyte Climacoptera lanata - has a salt-accumulating ability in the phytomass of which, depending on the growing conditions (degree of salinity of the soil), the amount of mineral salts can be up to 45-52%;
2. The results of vegetation and field experiments to study the level of soil salinity indicate that the cultivation of Climacoptera lanata can contribute to significant salinity of the soil. In vegetation experiments, the salinity reduction level decreased by 0.17%, and in field experiments this indicator amounted to 71%.
3. Climacoptera lanata - has good fodder qualities, is well eaten by sheep, goats and camels in the autumn-winter season, after precipitation and soaking of mineral salts contained in the phytomass. The climactopterium crop can be up to 43.8 c / ha of air-dry mass;
4. The agrotechnical features of cultivation are as follows: Seeds are sown on well-plowed and leveled harrowing soil. The optimal sowing dates are autumn-winter (December-February). The optimal seed placement depth is -1-2 cm. The sowing rate of seeds is 8-13 kg / ha. Plants are grown without watering;
5. In order to desalinate the soil at the end of the growing season, it is necessary to take out the plant mass, which can be used as livestock feed.

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