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The Influence of the Licorice Plant on the Change in the Amount of Toxic Salts in Saline Soils

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Abstract

The study of the influence of licorice on the water-salt regime of gray-meadow soils showed that licorice plays an important role in maintaining the groundwater level at an optimal depth, improving the physical properties of the soil and reducing the accumulation of toxic salts on the correct root layers of the soil.

Key words: salinization, salt regime, water regime, salinity, melioration, licorice, ground water, rate of decline of the level of groundwater, percolate irrigation regime, moisture regime, irrigation, irrigation network, plant forms, xerophytes, halophytes, restoration of fertility, phytomelioration, hydraulic engineering activities. agrobiological activities, agrotechnical activities.

Introduction

The creation of conditions for the equal development of all forms of management, as well as the strengthening of the rule of law in this area, is regulated by the Land Code of the Republic of Uzbekistan, enacted on July 1, 1998, where the organization of scientifically grounded, effective land use is promoted to the level of strategic objectives of state land management (2)

The consistent acceleration of agricultural production is of great importance for the rational use of land resources, the development of solutions to problems associated with increasing yields per hectare of irrigated land and its economic efficiency. In this regard, the preservation of soil fertility, its annual increase is one of the important tasks facing us.

The phenomenon of salinization, which negatively affects the fertility and ecological-ameliorative state of irrigated soils, is one of the processes occurring in the soil, and is of natural (primary) and anthropogenic (secondary) types. The main conditions causing natural salinization are associated with the rise of groundwater at the surface and poor drainage of the territory (1)

In order to prevent the accumulation of salts in the soil and secondary salinization, to establish the optimal water-salt regime and ensure complete soil salinization, first of all, the hydromorphic water regime (groundwater depth) 0.5-2.0 m), semi-hydromorphic (2 -3.0 m) water regime is the most optimal reclamation measure, allowing to maintain irrigated lands in good reclamation condition

In order to completely desalinate the soil, bring its fertility to a moderate level and get a guaranteed high yield, it is necessary to increase the specific length of drainage networks to at least 55-60 hectares, in some strong ones - 80-110 running meters and very highly saline, low permeability, heavy mechanical soils. Doing such a costly and time-consuming job is a challenge for many farmers.

In recent years, much attention has been paid to the use of plant resources as biological drainage with a decrease in the level of groundwater. Phytomelioration is of particular importance as a means of creating bioecological equality. It also increases the efficiency of the irrigation networks. It is one of the most convenient and inexpensive applications for reducing soil salinity

Therefore, it is necessary to use non-traditional reclamation measures, that is, the use of phytomeliorants (halophytic plants) to reduce soil salinization or prevent secondary

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salinization, form an optimal salt water regime, and maintain it at an optimal level. It should be noted that some halophytes can be used to prevent soil salinization and lower the groundwater level, since they have the ability to form biomass with high forage, nutritional and medicinal properties in saline soils. When choosing salt-tolerant plant species and varieties, it is desirable first of all to know the level and types of soil salinity. Because each plant species, resistant to salinity, shows its own characteristics in different conditions of soil salinity. Thus, the identification and selection of plants with such properties and their use are important for the restoration and improvement of the fertility of saline soils

Relevance of the topic.

Highly saline and saline soils are becoming obsolete in agriculture due to increased soil salinity and the fact that the harvest does not cover the costs. The restoration of these saline lands requires a lot of technical effort and large financial resources. Currently, there is a possibility of ecological rehabilitation of saline lands with the help of plant resources and the development of biodiversity in these territories without the need for large funds and large technical means.

It is noted that the introduction of a crop rotation system on irrigated areas, mainly cotton, partially reduces soil fertility, since the accumulation of the most toxic ions for plants is hydrocarbons, chlorides and sulfates.

According to the above, in the process of desalination of the gray-meadow soils of Syrdarya region, irrigation, flushing with salinity and the direction of movement of groundwater, directing their total flow from top to bottom, and then into the collectors-gutters, depending on the slope of the area. Is a key factor. At the same time, it is necessary to develop agro-reclamation measures, knowing the dynamics of seasonal changes in the amount of toxic salts in the soil.

Research object and materials

Field experiments to study the influence of Glycyrrhiza glabra on the water-salt regime of the soil were carried out on irrigated gray-meadow soils common on the territory of Galaba Water Users Association, Bayaut District, Syrdarya Region, with different lithological composition, geomorphological, hydrogeological and soil conditions. The soil of the study area is moderately and highly saline. The texture is medium loam.

Research results and discussion

According to M.U. Umarov, J. Ikramov, R. Kurvantaev, optimal density for irrigated heavy and medium sandy gray-meadow, meadow, loamy soils, formed on gray soils and desert areas, loessial, alluvial-proluvial, alluvial deposits 1, 2 -1.4 g / cm3 and a critical density of 1.5-1.6 g / cm3 is the best indicator. In the upper layer of light sandy soils, it is believed that the volume weight is about 1.34–1.43 g / cm3 [3].

The density of the solid part of the soil is a relatively stable unit that depends on the chemical, mechanical and mineralogical composition of the soil and the degree of humus content.

The results obtained show that the density of the solid part of the soil in the upper layers is less than in the lower ones, due to the fact that the amount of humus in the upper soil layer is slightly higher. In commonly irrigated gray-meadow soils, the density indices of the solid part of the soil do not differ much from each other, and they also through rapidly changing sizes (Table 1).

The soil density of the study area is variable and varies depending on the density of the solid part of the soil. This explains the uniqueness of the processes taking place in soils. The density of the studied soils varied; no sharp differences were observed between them.

The results obtained on the density of soils in the experimental plot show that, depending on the type of crops, humus content, mechanical composition, salinity, etc. They have different

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densities and vary within 1.32-1.46 g / cm3, s the highest soil density (1.40–1.46 g / cm3). On the experimental field planted with licorice, a layer-by-layer decrease in soil density was observed (Table 1)

General physical characteristics of the soil of the area planted with licorice (Bayaut district "WUA Galaba") 2020 Table 1

Layer depth , cm	The density of the solid part of the soil , g / cm^3		Soil density, g / cm^3		Total porosity,%	
	March	November	March	November	March	November
0-28	2,68	2,65	1,34	1,35	51,52	50,90
28-57	2,68	2,69	1,40	1,36	48,0	49, ,45
57-89	2,69	2,69	1,38	1,36	48,7	49, ,45
89-124	2,70	2,70	1,38	1,40	48,2	48,1
124-178	2,72	2,72	1,46	1,46	46,6	46,6
178-205	2,72	2,72	1,46	1,46	46,6	46,6

One of the key indicators of increasing the fertility of degraded soils is the level of bioproduction of degraded soils. Licorice provides greater accumulation of organic matter in the soil as a result of the rapid growth of the root system. As a result of planting the licorice plant, it was observed that the graininess of the soil layers increased, which in turn led to an improvement in the general physical properties of the soil

The results of the experiment showed that as a result of licorice cultivation, the total porosity of medium- and highly saline gray-meadow soils improved and approached the optimal state. The depth of the sweet root is 0.7-3.5 m (depending on the period of life and soil conditions). This in turn creates tiny voids in the soil layers. Thus, natural biological degradation occurs in the areas where licorice is grown. As a result of wide branching and deep penetration of the root system of plants, the number of agronomically significant aggregates (0.25-10 mm) increases, which in turn leads to a decrease in the density of soil layers.

It should also be noted that the root system of leguminous plants penetrates to different depths and the plant leaves a different amount of organic matter at the end of the growing season. If we introduce the correct crop rotation of these plants, as a result of the efficient use of moisture and nutrients, a quality crop will be obtained from the crops.

The data obtained on the dynamics of changes in the groundwater level show that for a 12-month period, the ground water level in Galaba water users association varied within 240 + 350 cm, i.e., the amplitude of the change in ground water level for the year was 110 cm (Table 2.3). This is mainly due to irrigation and rainfall, as well as the costs of transpiration through the plants. Covering the soil surface with permanent vegetation reduces the use of moisture for direct evaporation from the soil surface. This, in turn, prevents the rise of salts from the lower layers to the soil surface.

Based on the data obtained, it can be said that the licorice plant reduces the accumulation of water-soluble salts in the surface layers of the soil as a result of the fact that groundwater is absorbed by the roots and used for transpiration. The total amount of salts is the same, but with different soil composition, they can have different levels of salinity. This is due to the unequal toxicity of various salts and ions to plants.

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Dynamics of changes in groundwater levels in the experimental fields (Data for 2020)
Table-2.

No. of control well	Groundwater level, m					
	January	February	March	April	May	June
1	2,40	2,48	2,52	2,65	2,99	3,12
2	2,43	2,47	2,50	2,70	3,05	3,10
3	2,39	2,51	2,55	2,65	2,98	3,13
4	2,42	2,53	2,56	2,66	3,00	3,16
5	2,41	2,75	2,74	2,75	3,05	3,14

Table-2.

No. of control well	Groundwater level, m					
	Jul	August	Septembe	Oktober	November	Dekomber
1	2,62	3,32	3,43	3,45	2,76	2,35
2	2,70	3,40	3,45	3,45	2,82	2,46
3	2,83	3,45	3,51	3,51	2,89	2,50
4	2,96	3,50	3,50	3,50	2,88	2,42
5	2,94	3,48	3,55	3,55	2,88	2.39

Therefore, in the agrotechnical assessment of saline soils, it is very important to take into account the qualitative composition of salts, which are divided into non-toxic and toxic.

The toxicity limit is the limited amount of salts in the soil, which is determined by the growth and development of medium salt-tolerant plants on it.

The amount of toxic salts is mainly related to the increase in the amount of sodium in the soil. Depending on the accumulation of large amounts of some sodium salts, salinization can be sulfate, chloride, soda, or mixed. The most harmful effect is caused by ions Na + and SL-. The impact of salinity on plant organisms is due to two reasons: a deterioration in the water balance and the toxic effect of high salt concentrations. Salinization leads to a sharp decrease in free water reserves in the soil layers, making it difficult for plants to absorb water. Under the influence of salt, the structure of plant cells is disrupted, which mainly leads to a change in the structure of chloroplasts. This is observed with a more chlorinated type of salinity, which leads to a deterioration in the processes of transpiration and photosynthesis in plants.

High concentrations of Na + or CL slow down photosynthesis, which is associated with the sensitivity of phosphorylation and carboxylation processes to high salt concentrations. Increased salt concentrations slow down protein synthesis. High salt concentrations primarily affect the plant root system. In this case, the outer root cells that are in direct contact with saline are damaged. At the base, the cells of the conducting system are most sensitive to the effects of salts, through which the saline rises to the surface organs.

Therefore, in the agrotechnical assessment of saline soils, it is very important to take into account the qualitative composition of salts, which are divided into toxic and non-toxic.

The amount of toxic salts in the soil was calculated by adding the toxic amount of sulfate ions during absorption to the percentage of sodium, magnesium, chloride ions, i.e., By binding ions with hypothetical salts based on absorption in water from the sum, the total amount of salts) was determined by subtracting (1)

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Analysis of the data obtained in the study of the dynamics of changes in the amount of toxic salts in sweet fields shows that (Table-4.5) a sharp decrease in the amount of toxic salts in the surface layers of the soil was observed in the period after three years in comparison with the year of planting licorice. The main reason for this is that the level of saline groundwater is maintained at a certain depth and most of the water is spent on transpiration

Dynamics of changes in the amount of toxic salts in sweet fields (1st year) Table-4

№ Cutset	**Soil depth, См**	**$Ca(HCO_3)_2$**	**$CaSO_4$**	**$CaCl_2$**	**$MgSO_4$**	**$MgCl_2$**	**Na_2SO_4**	**NaCl**	**Total amount of salts**			
									Generfl	**Taxic**	**Non-taxic**	**Toxic salts in % of the total amount of salts**
1	0-15	0,016	0,254	0,064	0,215		0,297	-	0,846	0,576	0,270	68
	15-50	0,019	0,240	0,098	0,240		0,301		0,898	0,639	0,259	71
	50-100	0,030	0,310	0,144	0,294		0,247		1,025	0, 685	0,340	67
	100-200	0,043	0,352	0,152	0,317		0,203		1,067	0,672	0,395	63

№ Cutset	Soil depth, см	$Ca(HCO_3)_2$	$CaSO_4$	$CaCl_2$	$MgSO_4$	$MgCl_2$	Na_2SO_4	NaCl	Total amount of salts			
									Generfl	Taxic	Non-taxic	Toxic salts in % of the total amount of salts
1	0-15	0,014	0,216	0,019	0,093		0,175	-	0,517	0,287	0,,230	44,5
	15-50	0,018	0,202	0,056	0,103		0,226		0,605	0,385	0,220	63,6
	50-100	0,032	0,245	0,142	0,147		0,265		0,831	0,, 554	0,277	66,6
	100-200	0,042	0,292	0,148	0,217		0,325		1,024	0,690	0,334	67,4

Dynamics of changes in the amount of toxic salts in sweet fields (3st year) Table-5

Based on the data obtained, it can be concluded that the use of licorice as a phytomeliorant in saline soils prevents secondary salinization and prevents the accumulation of salts in the surface layers of the soil that are toxic for plant growth.

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