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Ecological Features of Improving the Biological Salt Resistance of Plants in the Conditions of Karakalpakstan

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Abstract: ***This article presents the environmental indicators of saline soils, the limits of their resistance to external and internal influences, and their impact on crop development. Methods for improving the biological salt resistance of plants in the Republic of Karakalpakstan are presented***

Keywords: Karakalpakstan, anthropogenic load, boundaries of soil stability, soil salinity, environmental indicators, salt resistance of plants.

1. Introduction

The ecological situation in modern agriculture is characterized by a high level of anthropogenic impact on agroecosystems, which is associated with the deterioration of soil fertility, salinity and the risk of desertification. Numerous studies have established that the environmental assessment of the state of the soil cover in changing soil and environmental conditions and increased anthropogenic pressure is one of the most important [2, 3, 5].

The ecological content of soil resources consists in the fact that their main component - the soil - ensures the normal functioning of the ecosystem inherent in this particular territory. Any violation of the soil leads to a change in the environmental situation, which can become irreversible [4]. In addition, all environmental protection systems and measures are more or less tied to the soil, on the safety of which their normal functioning depends [3].

2. Material and Methods

The purpose of the study is to develop the most effective crop rotation schemes that could ensure soil fertility and crop productivity in saline lands in a short time within the borders of each farmer, taking into account soil and climatic conditions and specialization [4, 5].

Local varieties of agricultural crops (cotton, wheat, cereals, forage, legumes, and siderats) were selected as the preceding crops. Agrochemical and agrophysical properties were studied, as well as the initial content of soil fertility elements of the experimental site [1, 2]. Soil, as the main environmental factor and the main object of agricultural production, needs environmental assessment in the agricultural sector of the economy. Therefore, it is necessary to identify the boundaries of soil resistance to external and internal environmental factors.

3. Discussion of Results

The Republic of Karakalpakstan belongs to the zone of high anthropogenic load, which has a strong negative impact on the state of its ecosystems. The situation is aggravated by the lack of water resources in the region, specific climatic conditions (high levels of solar radiation and summer heat resources, relatively weak atmospheric circulation) and difficult terrain [3]. Therefore, the issues of environmental protection and rational use of natural resources have acquired special relevance in the Republic of Karakalpakstan. One of the main factors determining the unfavorable ecological state of the earth is soil salinization. Saline soils are those that contain a significant amount of water-soluble mineral salts in the surface or deeper horizons. As you know, saline soils are divided into two large groups (two types): a) saline and saline soils, b) saline and saline soils [5].

Salt marshes include soils that contain a large amount of water-soluble salts in the surface and in the profile. Depending on the salinity chemistry, the salts in the upper horizon of salt marshes range from 0.6–0.7 to 2-3% or more. In the environmental assessment of saline soils, the terms "biological salt resistance" and "agronomic salt resistance" are used. Biological salt resistance – the ability of a plant to carry out a full cycle of individual development on saline soil, often with a reduced intensity of organic matter accumulation while preserving the reproduction of offspring [3, 4]. Agronomic salt tolerance is the ability of an organism to carry out a full cycle of development on saline soil and to produce products that meet agricultural practices in these conditions.

Solonets are soils that contain exchange sodium in colloids of the illuvial horizon in an amount of more than 15 % of the cation exchange capacity. Soils with the amount of exchange sodium less than 15% are classified as saline. In addition to adverse soil characteristics associated with salinity phenomena, exchange sodium has a physiologically negative effect on plants [1]. There is a violation of the ratio of calcium and sodium cations, which makes it difficult for calcium to enter the plants. Calcium, on the contrary, begins to be released from the roots into the soil. Salinity sharply reduces soil fertility, reduces the yields of most agricultural crops [1]. The division of soils according to the degree of salinization is due to different conditions of agricultural

plants on these soils. The same amount of salts, depending on their composition, may indicate a different degree of soil salinity, which is due to the unequal toxicity of various easily soluble salts for plants. Therefore, the degree of soil salinity is determined by the amount of dense residue (the sum of salts) and the content of ions that determine the chemistry (type) of salinity (table .1).

Table 1: Classification of soils by salinity level (according to Bazilevich, Pankova)

Degree of salinity	Chemism of salinity, dense residue (the amount of salts), %		
	Sulfate-chloride	Chloride-sulfate	Soda-chloride and chloride-soda
Non-saline	Less 0,1	Less 0,2	Less 0,1
Lightly salted	0,1-0,2	0,2-0,4	0,1-0,2
Medium- salted	0,2-0,4	0,4-0,6	0,2-0,3
Saline	0,4-0,8	0,6-0,9	0,3-0,5
Very strongly salted	More 0,8	More 0,9	More 0,5

In the irrigated areas of the Republic of Karakalpakstan, the unfavorable ecological state of the land is mainly manifested in the salinization of the soil. Scientifically based rotation of crops allows you to effectively fight not only weeds, diseases and pests, but also relatively prevents salinization of the soil during the vegetation development of the plant, thereby providing biological salt resistance to the main crop [5]. In this connection, it is the main link in the system of agriculture, which successfully combines the placement of crops, the system of applying fertilizers, soil treatment, reclamation and cultural and technical measures.

The research was conducted in the Northern zone of the Republic of Karakalpakstan. Data from field studies show a large dynamics of the salt regime of the soil. In particular, soil samples were taken at the beginning and end of the vegetation period at the horizons 0-30 and 0-50 cm to determine the water-soluble salts or salt regime, the values of the chlorine ion, and the dense residue after the previous annual crops. According to the initial salt content (0.021-0.063% chlorine ion), the test site is from weak to medium. By the end of the growing season, where cotton is sown (var. # 1) the coefficient of seasonal accumulation of chlorine-ion was about one (this is explained by small-scale frequent watering, which contributed to the desalination of the arable and sub-arable layer). At the end of the growing season in the 1st variant (cotton) on the horizons 0-30 and 0-50 cm in size of the dense residue, a change in the total salt content was observed (from 0.206-0.208 to 0.181-0.192%). For the second year, in variants 2,3,7,8 and 4,5 (sorghum and maize precursors), the change in the dense residue was small (i.e., from 0.201-0.376 to 0.183-0.357) (table.2).

Table 2: Content of water-soluble salts in the soil%

№ Pitch.	The soil horizon sm	Chlorine ion%		Coefficient of seasonal accumulation of chlorine-ion +	Dense residue%	
		At the beginning of the growing season	At the end of the growing season		At the beginning of the growing season	At the end of the growing season
1	0-30	0,038	0,051	-0,89	0,206	0,481
	0-50	0,046	0,041		0,208	0,492
2	0-30	0,032	0,041	-0,78	0,293	0,472
	0-50	0,054	0,042		0,296	0,475
3	0-30	0,038	0,043	-0,74	0,294	0,473
	0-50	0,061	0,045		0,309	0,387
4	0-30	0,039	0,043	-0,73	0,376	0,457
	0-50	0,042	0,031		0,366	0,448
5	0-30	0,033	0,045	-0,71	0,329	0,413
	0-50	0,053	0,038		0,329	0,415
6	0-30	0,030	0,049	-0,80	0,371	0,534
	0-50	0,036	0,029		0,292	0,463
7	0-30	0,031	0,033	-0,81	0,250	0,428
	0-50	0,023	0,019		0,223	0,503
8	0-30	0,033	0,028	-0,84	0,245	0,523
	0-50	0,021	0,018		0,201	0,483

Thus, annual crops such as sorghum and maize leave a significant amount of crop residues in the soil, which under the influence of microorganisms are converted into organic substances, i.e. they provide biological salt resistance for the main crops. According to the results of research, farmers of the Republic of Karakalpakstan are recommended to use rotation crop rotations with a 1:2 scheme with a cotton content of 66%. To increase soil fertility and yield of cotton, use sorghum, corn and sesame as precursors, and after harvesting, apply organic fertilizers at the rate of 10 t / ha.

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