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Ecological-meliorative state of soils of the Beruniy region

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Abstract: *The article provides materials on the ecological and reclamation state of soils in the Beruni region of the Republic of Karakalpakstan. We laid soil profiles in the most typical irrigated soils of the region and took soil samples and samples of ground, drainage and irrigation water for chemical analyzes.*

Key words: *Salinity, type and degree of salinity, toxic salts, soil degradation, groundwater level, collector-drainage systems.*

1. INTRODUCTION:

Today, due to land salinization, the ecological situation in Karakalpakia is in a catastrophic state. Salt not only reduces the yield of agricultural crops, but also leads to deterioration of the foundations of buildings and structures. Due to the saturation of the air with salt dust, the number of respiratory and other diseases among the population is increasing. Salt seizes asphalt road surfaces, concrete and iron poles of high-voltage power lines, as well as communication facilities, as a result of which they quickly wear out and become unusable. In this region, land salinization is one of the most important problems today, which requires an immediate solution. For this purpose, it is necessary, first of all, to assess the ecological and reclamation situation in the region, to identify the degree and types of salinization, to calculate the gross stocks of water-soluble and toxic salts, which will make it possible to determine the measures of reclamation measures, and subsequent reclamation and restoration of landscapes, and primarily agricultural land.

According to the international organization FAO-UNESCO, by the end of the 21st century, due to periodic losses of land fertility around the world, 1/3 of all arable land may be irretrievably lost. According to UN experts, by the end of the twentieth century, 9 million km2 of degraded land due to human activities were registered, which is 43% of the total land area of the globe. Currently, desertification affects 1/6 of the world's population. [2].

Three main factors can be cited that affect the ameliorative and ecological state, that is, salinity, which also leads to an intensification of landscape degradation processes and a decrease in the vegetation cover of South Karakalpakia. These include; A) Mineralized groundwater located above the critical level. B) Irrigation waters containing exceeding the permissible concentration of salts, which are used as flushing and vegetative irrigation. C) Dust-salt deposits carried through the atmosphere from the dried bottom of the Aral Sea [1].

To create a green barrier and reduce the spraying of toxic salts in 2019, Uzbekistan sowed 500 thousand hectares, in 2020 700 thousand hectares of the dried bottom of the Aral Sea with salt-tolerant and halophytic plants.

According to R.K. Kuziev, “On lands with severe reclamation conditions, special attention should be paid to the structure of agricultural crops, and salt-tolerant plants play an important role in this. In addition to leaching operations, it is necessary to effectively apply other methods of amelioration, such as chemical and biological ”[8].

2. MATERIALS AND METHODS:

In the research work, the methods of laying soil sections were applied in the selected areas, laboratory and analytical studies were carried out according to the methodology "Methods of agrochemical analyzes of soils and plants in Central Asia" [5]. Soil sampling and laboratory chemical analyzes were carried out according to the generally accepted methods specified in the methodological manuals of E.V. Arinushkina - "Methods of agrochemical, agrophysical and microbiological research in irrigated cotton regions" [7] as well as "Guidelines for the chemical analysis of soils" [4] and "Guidelines for chemical and agrophysical analyzes of soils during land monitoring" [3], statistical processing of analytical data was carried out by the method of B.A. Dospekhov [3].

3. RESULTS:

The research materials show that the process of salt accumulation on the surface horizons and the secondary salinization of soils in the Beruniy region are primarily associated with an increase in the groundwater level. Due to the very weak natural drainage, the groundwater of these territories is stagnant and is mainly spent on evaporation from the surface layers of the soil. There are main collectors, inter-farm and on-farm collector-drainage systems in the region. In places where collector and drainage systems require major repairs, as well as in places where the length of these systems does not fully cover the cultivated areas, secondary soil salinization occurs. During the autumn-spring leaching works,

the soils are washed with very high rates of water and at this time the collector-drainage systems operate under high stress, in some cases their efficiency is not sufficient to reduce the level of groundwater on irrigated lands. In the areas of the Lower Amu Darya, the situation requires that even non-saline areas require spring leaching for prevention purposes. This is explained by the fact that a whole year from the side of the dried Aral Sea through the atmosphere brings salt dust and, moreover, climatic conditions predetermine the susceptibility of these lands to salinization.

The results of analyzes of the water extract of soils show that by the location in the profile of the salt horizon, their thickness of the horizon and by the content of salts, the soils of the region are saline of varying degrees (1-rice). On lands located close to the river, they are not saline (washed out) or have a slightly saline character. In areas located far from irrigation systems, depending on soil cultivation, as well as the effectiveness of leaching operations, they are saline to a weak, medium and strong degree.

Some contours that were mastered in the last century, due to the rise in the level of groundwater and the intensification of the process of secondary salinization, became unusable, as they were salinized with a very strong degree of salinity. It is possible to note at least two reasons for the withdrawal of sown areas from agricultural use; 1. Very strong degree of salinity and ineffective nature of the land reclamation works carried out in these areas. 2. Due to untimely repair of irrigation systems, or a remote location from water sources, some areas were abandoned, as they cannot be provided with irrigation water on time.

Despite the huge costs for improving the meliorative state and the consumption of a huge volume of water, the ecological and reclamation (soil salinization) state of the Beruni region is clearly unsatisfactory, in the area of land of varying degrees of salinity it accounts for 90.26% of the total area used in agriculture (Fig-1). Of these, 37.78% is weak (B), 40.29% is medium (C), 10.14% is strongly (D) and 2.05% (A) is very highly saline, non-saline areas (E) are only 9.74 % (Fig-1).

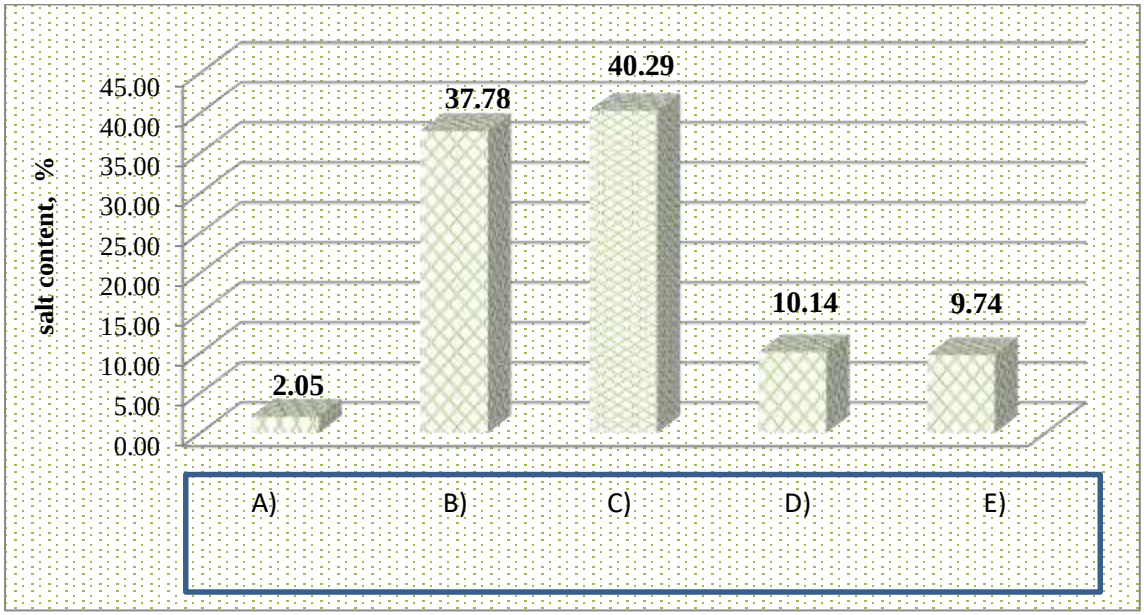

Fig-1: Areas of saline irrigated lands by the degree of soil salinity in the Beruniy region, in %

Massif named after U. Dzhumaniyozov, Beruniy region. Irrigated alluvial meadow soils (Section 1A, 2A, 3A, 4A). Most of them contain slightly saline horizons in their profile, but in some territories there are soils with moderately saline horizons. The non-saline horizons are mainly located under the plow bottom. The total amount of water-soluble salts in the aqueous extract ranges from 0.210% to 0.505%. According to the type of salinity, chloride-sulfate soils usually dominate, but in some territories there are soils with horizons with a sulfate type of salinity, and in rare cases with a sulfate-chloride type of salinity. Of the anions, sulfates are predominantly dominant; their amount ranges from 0.076% to 0.267%. Chlorine contains from 0.011% to 0.063%. Bicarbonates in some sections exceed the amount of chlorine ion, but in other sections they have a closing place and are contained in an amount from 0.024% to 0.040%. Sodium content dominates among cations, their amount ranges from 0.009% to 0.164%. The amount of calcium ranges from 0.007% to 0.060%. Magnesium ions mainly occupy the closing place and are contained in the dry residue in an amount of 0.003-0.180%. The reaction of the aqueous extract (pH) is very close to neutral and has a pH of 7.07-7.80 (table-1).

The bog-meadow soils of the U Dzhumaniyozov massif of the Beruniy district (section-5A) are formed by their origin on the lands that were previously under saline lakes, mainly in areas with a relatively low relief and have shallow mineralized groundwater. These soils very often have saline spots that are devoid of vegetation. In section-5A of Table-1, we see that in the arable layer the amount of water-soluble salts is 4.405%, with a gradual decrease to the bottom and

amounts to 0.415% in the 86-100cm horizon. The chemistry of salinity also changes along the horizons. The soil profile contains horizons of chloride, sulfate-chloride, and chloride-sulfate types of salinity. The chlorine content dominates in the arable layer, and sulfates in the rest. The amount of chlorine along the profile ranges from 0.102% to 2.321%. Sulfates range from 0.121% to 0.732%. The amount of bicarbonates ranges from 0.024% to 0.037%. Of the cations, the content of sodium ranges from 0.015% to 0.529%, magnesium from 0.032% to 0.486% and calcium from 0.050% to 0.305%. The indicator of the reaction of the soil medium (pH) ranges from 7.07 to 7.80 (1-table).

Table 1.

The composition of the water extract and the chemistry of soil salinization in the U. Dzhumaniyozov massif of the Beruniy region

Sample №	Depth, cm	Dry residue	HCO_3	Cl	SO_4	Ca	Mg	Na	Salinity		pH
		%%							Type	Degree	
Alluvial-meadow soils											
1A	0-36	0,290	0,030	0,025	0,111	0,02	0,015	0,029	ch-s	Average saline	7,31
	36-61	0,505	0,027	0,052	0,267	0,007	след	0,164	ch-s	Average saline	7,49
	61-84	0,410	0,033	0,07	0,138	0,03	0,018	0,055	ch-s	Average saline	7,54
	84-120	0,490	0,030	0,063	0,200	0,035	0,021	0,068	ch-s	Average saline	7,47
	120-158	0,415	0,030	0,035	0,175	0,035	0,003	0,072	ch-s	Average saline	7,30
2A	0-30	0,370	0,037	0,035	0,156				ch-s	Average saline	
	30-49	0,240	0,027	0,021	0,097				ch-s	Low saline	
	49-77	0,210	0,033	0,011	0,086				s	No saline	
	77-100	0,305	0,037	0,014	0,138				s	Low saline	
	100-145	0,390	0,030	0,042	0,165				ch-s	Average saline	
3A	0-33	0,350	0,030	0,025	0,138	0,025	0,006	0,054	ch-s	Average saline	7,38
	33-50	0,310	0,027	0,018	0,123	0,02	0,018	0,024	s	Low saline	7,33
	50-97	0,220	0,024	0,014	0,076	0,025	0,009	0,009	ch-s	Low saline	7,25
	97-146	0,400	0,027	0,011	0,195	0,06	0,003	0,036	s	Low saline	7,30
4A	0-30	0,255	0,037	0,014	0,103				ch-s	Low saline	
	30-51	0,320	0,037	0,011	0,146				s	Low saline	
	51-82	0,250	0,024	0,014	0,113				s	No saline	
	82-105	0,330	0,027	0,021	0,152				s	Low saline	
	105-161	0,235	0,040	0,025	0,086				ch-s	Low saline	
Bog-meadow soils											
5A	0-38	4,405	0,037	2,321	0,582	0,305	0,486	0,529	ch	Very high saline	7,07
	38-67	1,995	0,027	0,658	0,732	0,220	0,222	0,115	ch-s	Very high saline	7,36
	67-86	0,740	0,037	0,154	0,325	0,085	0,075	0,030	ch-s	Average saline	7,62
	86-100	0,415	0,024	0,102	0,121	0,050	0,032	0,015	s-ch	Average saline	7,80

4. CONCLUSION:

To date, some changes are taking place in the soils of the Beruni region of the Republic of Karakalpakstan, related to their ecological and reclamation state. On the one hand, due to the periodic shortage of water, some territories are prone to desertification, but on the other hand, due to the unreasonable use of the water of the Amu Darya River and because of the unsatisfactory condition in some places of the collector-drainage systems, the process of secondary salinization of irrigated lands is underway. Irrigated soils here are saline to varying degrees and have very different salinity chemistry (type).

To improve the ecological and reclamation state of the soils of these lands, first of all, the level of groundwater should be reduced to a critical level. This can be achieved through the use of innovative resource-saving methods for the use of water resources, against the background of timely purification of collector-drainage and irrigation systems. It is necessary to reduce the volume of water filtration from irrigation canals and sown areas to a minimum or zero level. For sowing on saline irrigated lands, you need to pay great attention to crops and varieties that are not demanding for moisture and are resistant to salinity.

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