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CHANGE OF AGROCHEMICAL AND MICROBIOLOGICAL INDICATORS OF MEADOW SOILS OF THE BUKHARA REGION DEPENDING ON THE DEGREE OF SALINATION

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Annotation. The article presents data on the influence of the degree and types of salinization on the microbiological and agrochemical properties of meadow soils Bukhara region. It was shown that water-soluble salts of saline soils affect the agrochemical properties of soils not only indirectly through microbiological processes, but also directly as chemical substances that determine the conditions for the occurrence of chemical processes.

Keywords. Agrochemical property, microorganisms, meadow soil, salinization, salts, humus, nutrients

Introduction. The study of changes in the agrochemical parameters of meadow soils under the action of water-soluble salts, depending on the amount and form of salts, is of great importance in understanding the formation of the agrochemical properties of these soils. The content and forms of salts strongly influence the activity of microorganisms involved in those processes in which nutrients are formed that determine the agrochemical properties of the soil. In the studies of S. Murodova [6], the largest amount of humus was found in non-saline irrigated meadow sierozem soil (2.06%) and the lowest amount in highly saline meadow sierozem soil (0.73%). At the same time, the number of ammonifying bacteria decreased sharply. The negative effect of salt on the biological activity of soils is associated primarily with a sharp increase in osmotic pressure. Salinization reduced the intensity of development of aerobic hydrocarbon-containing microorganisms in comparison with non-saline soil [7]. Studies by foreign scientists have shown that the inoculation of seeds of agricultural crops with rhizobacteria of the genus Azospirillum significantly mitigate the negative effect of salinity [10.11.12.13]. In highly saline soils with a high “pH” content, the alkaline effect was the main obstacle to the development of nitrogen-fixing, nitrifying, and cellulose-decomposing bacteria. In these soils, the group composition of microorganisms turned out to be very poor, and the depth of penetration into the soil was very small. In alkaline saline soils, the number of fungi also significantly decreases [1]. The same data were obtained by other scientists [2,3,4,5,8,9]. Therefore, the study of the influence of the degree and types of salinity on the agrochemical and microbiological properties of soils is relevant.

For this purpose, in the Bukhara region, soils were selected that differ in the degree of salinity: non-saline, weakly, moderately and strongly saline. Soil cuts were made and soil samples were taken along genetic horizons. In these soil samples, the total content of water-soluble salts, the amount of cations and anions in the water extract were determined according to generally accepted methods. The content of humus was determined according to Tyurin, ammonium nitrogen - with Nessler's reagent on FEC, nitrate nitrogen - according to the Grandvald-Lage method, mobile phosphorus - according to Machigin, exchangeable potassium - according to Protasov, the reaction of the soil environment - potentiometrically on a pH meter.

The number of bacteria and ammonifiers - on meat-peptone agar (MPA) in 5 dilutions of an aqueous soil suspension, fungi - on Czapek's medium in 4 dilutions of an aqueous soil suspension, actinomycetes - on starch-ammonia agar (CAA) in 5 dilutions. Of the physiological groups of microorganisms, the number of nitrogen fixers was studied on Ashby's medium (5 dilutions), nitrifiers on Winogradsky plates (4 dilutions), and nitrate reducers on Giltai's medium (5-6 dilutions).

The study shows that the degree and type of salinity have a great effect on the number and activity of microorganisms and their taxonomic and physiological groups, which greatly affects the formation of nutrients and the formation of agrochemical properties (table). At the same time, the high content of water-soluble salts in the soil in itself affects the agrochemical properties of the soil, mainly on the reaction of the environment. The high sodium content in the soil solution and the soil absorption complex (SAC) increases the pH value and causes soil alkalini-

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ty. This greatly increases the solubility of humic substances, which leads to their leaching and rapid decomposition. This is especially pronounced when the content of carbonate ions in the soil increases. The carbonate ion, as an anion of a weak acid, increases the alkalinity of the medium upon hydrolysis of its sodium salt. The high content of chloride and sulfate ions does not affect the reaction of the environment (pH), since these ions are not chemically hydrolyzed in the soil. But their high content adversely affects the vital activity of microorganisms and the physical properties of the soil (table). The toxic effect of chlorine on living organisms is also manifested in the vital activity of microorganisms. With a high content of chlorine, the amount of nitrates is greatly reduced and the ratio of ammonium to nitrates in the soil is disturbed. The relative content of ammonium nitrogen in the soil increases in comparison with nitrate, which increases the toxic effect of the soil in relation to microorganisms and, in special cases, to plants. An increase in the content of sulfates leads to the formation of gypsum and gypsum-bearing soils. Gypsum greatly worsens the physical properties of the soil, the conditions for microorganisms and plants.

With an increase in the content of water-soluble salts in the soil, the microbiological processes of humus formation worsen, as evidenced by the low content of humus in highly saline meadow soil compared to non-saline and slightly saline meadow soils (table). In moderately saline soils, the humus content was also low. These regularities are observed both in the arable and subarable soil layers.

In the series of non-saline → slightly → medium → strongly saline soils, the number of bacteria, fungi, actinomycetes, nitrogen fixers, nitrifiers, nitrate reducers, cellulose-decomposing bacteria and bacteria growing on mineral nitrogen from left to right, i.e. in the direction of increasing the content of water-soluble salts decreased. At the same time, the activity of the processes in which these microorganisms participate decreases, which causes a special formation of the agrochemical properties of each soil, which differ in the degree and type of salinity.

With an increase in salinity, the content of both ammonium and nitrate nitrogen decreases (table). But at the same time, the decrease in the content of nitrate nitrogen prevails over the decrease in ammonium, which greatly disrupts the ratio of these forms of nitrogen in the soil compared to non-saline soils.

Both the process of humus formation and the processes of ammonification and nitrification, in which ammonium ions and nitrates are formed, respectively, strongly depend on the activity of microorganisms involved in these processes. And water-soluble soil salts greatly affect the number and activity of these micro-organisms. Soil salinity strongly affects the content of mobile phosphorus. In non-saline and slightly saline meadow soils of the Bukhara region, the content of mobile phosphorus was higher than in medium and highly saline soils (table). This suggests that salinity affects the formation and content of mobile phosphorus. However, with an increased content of the sodium cation, for example, solonetsous soils or solonetzes, the content of mobile phosphorus increases. The sodium cation increases the mobility of phosphates, which increases the available phosphorus for plants (table). In gypsum soils, the content of mobile phosphorus is lower than in solonetz soils and solonetzes. The content of mobile phosphorus in the soil also depends on the processes of nitrification and formation

sulfates, as well as the reaction of the environment (pH) of the soil. With an intensive course of the process of nitrification and the formation of sulfates, the pH value decreases, i.e. changes towards acidity, which increases the solubility of phosphates and increases the content of mobile phosphorus. In natural conditions, i.e. in virgin soils, it depends on the time of year, soil and air temperature, soil moisture and precipitation, salinity and salt composition, mechanical composition of the soil. With a light mechanical composition and the condition of non-saline soils, the processes of nitrification and the formation of sulfates proceed more quickly compared to saline soils and with a heavier mechanical composition of the soil. Since, a more volumetric presence of oxygen (air) and the content of water-soluble salts within the normal range, especially toxic salts, contribute to the normal course of the processes of nitrification and the formation of sulfates. With poor soil aeration and a high content of water-soluble salts, especially toxic ones, the vital activity of nitrifiers and microorganisms involved in the oxidation of sulfur-containing compounds in the soil to sulfates is inhibited. This leads to a decrease in the content of nitrates and mobile phosphorus in the soil, which is observed in saline and heavy textured soils.

Table
Influence of different degrees and types of salinity on the number of microorganisms and nutrient content

Degrees of salinity	horizon, cm	Number of microorganisms						Agrochemical properties				
		Bacteria, million/g soil	Fungi, thousand/g soil	Actinomycetes million/g soil	Nitrifiers, thousand/g soil	nitrate reducers million/g soil	nitrogen fix ers mln/g soil	Humus, %	N-NH4, mg/kg	N-NO3, mg/kg	P2O5, mg/kg	K2O, mg/kg
Unsalted	0-30	28,5	45,2	6,2	75	25,5	31,5	1,12	22,5	24,4	18,8	230
	30-70	12,4	28,5	4,7	42	14,5	20,8	0,96	18,8	20,5	16,5	220
	70-100	7,8	3,5	2,2	7	8,8	10,5	0,78	14,3	16,6	13,2	200
Slightly salted	0-30	23,5	38,3	4,4	67	20,6	23,3	0,98	18,3	17,8	15,2	200
	30-70	10,1	24,6	3,7	38	12,5	14,5	0,85	16,0	15,7	13,5	200
	70-100	6,4	3,3	1,6	5	7,0	8,2	0,67	11,5	10,7	11,1	180
Medium saline	0-30	13,4	22,5	2,8	38	15,1	14,7	0,82	12,5	8,6	14,5	180
	30-70	7,6	17,5	1,1	24	9,5	9,5	0,73	8,7	6,5	12,0	160
	70-100	5,1	2,3	0,6	3	5,8	6,0	0,59	5,2	4,8	9,4	140
Highly salted	0-30	9,8	14,5	1,5	21	9,5	9,4	0,78	10,3	8,2	10,3	170
	30-70	5,6	8,7	0,6	9	6,3	6,8	0,63	8,0	7,1	8,4	150
	70-100	2,5	1,6	0, 3	0,83	3,1	3,2	0,50	4,6	4,0	6,5	120

The content of exchangeable potassium depends more on the mechanical and mineralogical composition of the soil than on soil salinity.

The high content of carbonates contributes to the alkalization of the soil, which affects the nutrient regime and agrochemical properties of the soil. In an alkaline environment, due to purely chemical processes, the loss of ammonia increases by volatilization in the form of a gaseous substance - ammonia, which is observed in highly saline soils, especially carbonates. All this should be taken into account when cultivating crops and applying nitrogen fertilizers. Increasing the pH value, i.e. alkalization of the soil, reduces the mobility of most trace elements, such

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as iron, manganese, boron, zinc, copper and others. Therefore, a decrease in the pH value towards acidity increases the content of mobile forms of microelements and phosphates, which improves the nutritional regime of saline meadows soils of the Bukhara region. This increases the number of taxonomic physiological groups and the activity of the processes in which these groups of microorganisms participate. At a very high pH value (10 or more), the vital activity of urobacteria stops, which determine the urease activity of the soil, at which urea is converted into ammonium, which is greatly lost at a high pH value. This has a negative effect on ammonification processes. Under such conditions, the use of urea, an artificial analogue of urea, does not give the desired effect, since urea in the soil with the help of urobacteria and their urease enzyme must be converted into ammonium before their plants will use them.

Thus, soil salinity strongly affects the formation of its agrochemical and microbiological properties. The agrochemical and microbiological properties of the soil are affected not only by the degree, but also by the types of salinity.

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