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Research Article

The Elemental Composition of Soils of Saline Agrolandscapes and Sanitary-Hygienic Conditions of the Southern Part of the Prichanovskaya Depression

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Annotation

Studying the macro- and microelement composition of the soils of the saline agrolandscape of the southern part of the Prichanovskaya depression, it was established that meadow-chernozem poorly saline sandy soil was formed in the eluvial position, and low-saline solonchikovy clayey soil in the bottom. Of macronutrients in them is dominated by silicon. Calcium is more than magnesium, especially in the soil horizons of the lower position. The content of trace elements in the soil of the lower position is 2-3 times higher than at the top due to their movement with surface and groundwater. The content of arsenic, barium, boron and strontium is several times higher than the MPC, which creates a difficult situation in the area, which must be considered in the production of agricultural products.

Keywords: Saline agrolandscape; Catena; Macro and microelements; Sanitary and hygienic conditions

Introduction

Currently, agricultural production is undergoing great changes. The main direction of use becomes its greening on a landscape basis. The founder of this direction is BB Polynov [1]. The landscape is a large and complex dynamic system of the earth's surface, within which interaction and interpenetration of the elements of litho, hydro, and atmosphere occur [2]. In connection with the agricultural use of the territory, a variety of landscape began to stand out-an agroland landscape, which takes into account all its peculiarities of development and existence-climatic, biological, lithological, soil, etc. Such major scientists - soil scientists as VA Kovda [3], Kiryushin VI [4], who were forced to look at this problem differently than in the previous research period. Earlier, in the development of zonal farming systems for the rational use of soil cover, zonal features of the territory were mainly taken into account. It turned out that with soils and living organisms in it and on it, scientific substantiation, accuracy and thoroughness of agrotechnical and ameliorative treatment is necessary. Underreporting and lack of knowledge of natural conditions, especially of the soil cover, is one of the reasons for low yields. With the scientifically based and effective management of soil fertility, two difficult tasks are solved: obtaining high and stable yields and increasing soil fertility. At the same time, it is important to know the chemical composition of soils belonging to a particular landscape and the direction of geochemical processes within it. The purpose of these studies is to study the chemical elemental composition of the soil and the sanitary and hygienic situation in the saline agrolandscape of the southern part of the Prichanovskaya depression, which is part of the Barabinskaya plain.

Research Tasks

a) To study the macronutrient composition of catena soils: meadow-chernozem ordinary low-power low-rich sandy loam-eluvial (high) part of the agrolandscape and meadow-marsh saline heavy clay-accumulative (low).

b) To determine the microelement composition of these soils and to identify the sanitary and hygienic environment of the studied saline agrolandscape. In fulfilling their goals and objectives, they used modern approaches to study selected agrolandscapes [4-6]. In 1990, an agromeliorative grouping of sone-almonds and recommended measures for their improvement were developed for sodic and saline soils in 1990 [7]. Currently, this group is outdated. It does not match the approaches to the development of adaptive-landscape farming systems. Therefore, an agroecological typology of lands of the Barabinskaya lowland was proposed, which underlies the present work [6].

Objects and Methods of Research

The studies were conducted in the southern part of the Prichanovskaya depression of the Barabinskaya lowland, which covers 65.5% of the territory of the Novosibirsk region or 11.7 million hectares. Here, in the immediate vicinity of Lake Chany, we laid two soil cuts in a saline agrolandscape in the form of catena. The incision (P40)-on the elevated mesorelief (eluvial position) and the incision (P_{21})-in the lower part (accumulative position).

The Location of the P40 Soil Section is as Follows

Chistyozerny region of the Novosibirsk region, dry meadow, eastern apical part of the margin of the mane (76° 45' 09.08" N). Height above sea level-120 m. The soil is a meadow-chernozem ordinary medium-power poorly mature sandy sand, and the P_{21} cut (54° 46' 52.1".N., 76° 50' 22.3" E), height above sea level-103 m; grass-wormwood meadow, boils from HCL from the surface. Groundwater-from 60cm. Soil: meadow-marsh saline, heavy clay (Table 1) (Figure 1).

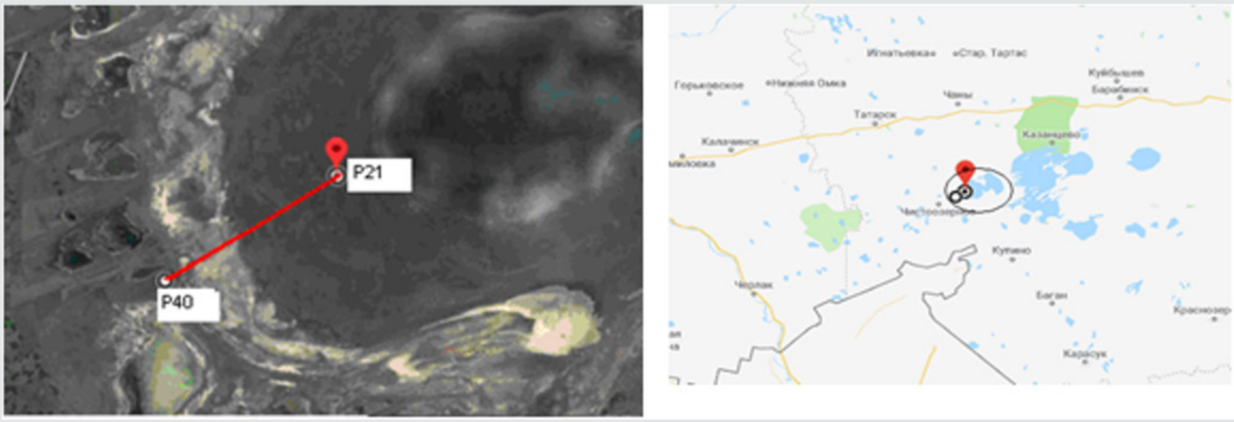

Figure 1: The location of the cuts on the saline agrolandscape (satellite image).

Table 1: Physico-chemical properties of catena soils in the saline natural landscape of the southern part of the Prichanovskaya depression.

Catena position Cut number, soil	Horizon, its Power is the Depth of Taking a Sample (cm)	Gumus, %	P^H H_2O value	Physical clay (particles <0.01 mm)	Cation Exchange			Cation Exchange Capacity
					mmol –eq / 100g soil			
					Ca^{2+}	Mg^{2+}	Na^{1+}	
Eluvial R_{40} meadow-chernozem solodated sandy loam	A_1 - 0-18 Mar-18	5,7	6,8	14,8	16,15	3,6	0,16	19,91
	A_{11} - 18-30 18-30	4.5	7.1	14.1	14.1	3.9	0.07	18.07
	AB - 31-49 35-45	1,1	7,3	36,1	12,35	3,65	0,11	16,11
	B_2-61-93 70-80	0,5	8,9	29,4	Not opred		0,17	9,52
	CCa-95-105 90-100	0,2	9,0	26,9	Not opred		0,22	10,08

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Accumulative, P21 meadow - marsh saline, heavy clay	from- 0-7 0-7	5,9	8,7	72,2	Not opred		4,35	35,64
	A1g - 7-33 Oct-20	2,8	9,0	88,1	Not opred		9,14	29,70
	Bg - 33-60 40-50	2,8	8,6	66,1	Not opred		18,27	27,72
	G - 60-75 65-75	2,5	8,6	51,1	Not opred		23,05	27,72

Discussion of the Results

The gross content of 7 macroelements-Si, Fe, Al, Ca, Mg, Na, P (Table 2) was determined. From the data of (Table 2) it can be seen that the macro element Si dominates in the soils. On the eluvial position, its catena is twice as large as in the accumulative position, which is associated with weak leaching and movement of silicon by surface flows. Somewhat different There were results on the content of Ca and Mg. In both soils, the Ca content prevailed over the Mg content. With depth along the profile, the amount of calcium increased dramatically, especially in meadow-marsh saline soil, since the latter is located in a modern lakeside belt, where conditions are created for its enrichment in a biogenic way (during spill, die-off mollusks, etc.) and due to soluble salts. The magnesium content in both soils is distributed more or less evenly. With depth, its amount gradually increases, and in the accumulative zone it is almost 3 times more than in the eluvial one. The sodium content in the upper horizons of the meadow-chernozem soil (eluvial positions) exceeds the contents of Ca and Mg and is slightly less than in the hell and Al horizons of the marsh, which indicates a periodic enhanced leaching of these horizons during floods. Phosphorus is slightly more contained in the salt marsh in the accumulation zone, where natural conditions are created for its accumulation in anaerobic conditions.

Table 2: The profile distribution of the gross content of macroelements in the saline natural landscape of the southern part of the Prichanovskaya depression.

Catena Position Cut No. the Soil	Horizon, its Power, the Depth of Taking the Cut, (cm)	Macronutrients, mg / kg							
		Si	Fe	Al	Ca	Mg	Na	P	K
Eluvial, P_{40} meadow chernozem solodized	A_1 - 0-18 03-18	4,49*105	20100	66600	9770	5710	13700	777	Not opred
	A_1' - 18-30 18-30	4,01*105	20400	59300	8400	5490	13800	635	Not opred
	AB - 31-49 35-45	4,01*105	18100	56400	6810	5110	12700	363	Not opred
	B_2 - 61-93 70-80	4,10*105	18900	68200	30800	7070	14400	454	Not opred
	CCa - 95- 105 90 - 100	4,01*105	19100	61700	26100	6800	12900	449	Not opred
Accumulative, P_{21} meadow-marsh, saline, heavy clay	Ad - 0-7 0-7	2,62*105	40600	Не опред.	58800	23500	6140	956	27000
	A1g - 7-33 10-20	2,43*105	35300	90900	78500	24200	10800	739	21600
	Bg - 33-60 40-50	2,20*105	35700	88600	77600	26900	12600	593	25900
	G - 60-75 65-75	2,37*105	35000	95100	99700	27100	13700	687	27600

Summarizing the content of macronutrients in catena soils, it can be noted that the eluvial positions in the natural saline landscape in the hemihydromorphic soil profile contain less macronutrients than the soil profile in the accumulative positions by about 2-3 times. The issue of distribution of trace elements in the soil scientists pay great attention. In particular, a number of monographs on the Novosibirsk region and the city of Novosibirsk were published [8-10], where the authors highlight the problem of the great importance of trace elements in the life of plants, animals and humans. A brief description of the biological role of individual chemical elements, even those whose significance for living organisms is not enough or little is known [8]. The authors of this monograph conducted biogeochemical zoning of the territory of the Novosibirsk region. Thus, within the region, two biogeochemical provinces have been identified, which include 8 biogeochemical regions (BR). They are significantly different in environmental stress.

Object of Study

According to this regionalization, is located in the Barabinskaya Plain in the extensive biogeochemical province 1 (BGHP-1). It is characterized by a wide distribution of saline rocks and soils, mineralized groundwater, groundwater and surface water, a lack of Co and Cu, an unfavorable ratio in Ca: Mg plants. Here the most complicated biogeochemical situation has developed. This report provides an analysis of 14 microelements and examined their content depending on the position of the sections along the catena-upper (eluvial) and lower (accumulative) positions.

Pb is lead. In medicine and in biology, interest in this element is associated exclusively with its toxicity for all living things. However, it has now been established that lead in small amounts (for plants from 2 to 6mg/kg of dry matter and animals from 0.05 to 0.5mg/kg) is necessary for their normal life activity [11,12]. Plant resistance to excess lead is different-legumes are more resistant, and less so are grains. Signs of toxicity to an excess of lead in plants for this reason can occur when its total content in the soil varies from 100 to 500mg/kg [13,14]. The data we obtained (Table 3) indicate that for catena in eluvial and accumulative positions, the total lead content ranges from 10.5 to 26.0mg/kg of soil. This amount is significantly less than the MPC-100mg/kg [15]. In the upper humus horizons its content is found more, and in the lower-somewhat less. In the eluvial zone in the profile of the meadow-chernozem soil slightly less than the accumulative. Our data indicate that there is no significant change in the Pb content in the profile of both soils. Only in the hell horizon of the meadow-marsh saline soil, the amount of Pb increases to 26mg / kg of soil, which indicates its transformation from the upper eluvial positions to the lower accumulative ones.

Table 3: The profile distribution of the gross content of trace elements in the soils of the saline agrolandscape of the southern part of the Prichanovskaya depression.

Catena Position Cut No. the Soil	Horizon, its Power, the Depth of Taking the Cut, (cm)	Macronutrients, mg / kg													
		Pb	As	Cd	Ba	Br	Mn	Cu	Cr	Mo	V	Zn	Co	Sr	Ni
Eluvial, P_{40} meadow chernozem solodized	A1 - 018 03-18	17,6	21,6	0,752	676,0	53,0	855,0	28,5	76,1	3,4	67,7	49,8	8,18	233,0	29,8
	A1 - 18-30 18-30	16,2	20,9	0,253	559,0	57,8	731,0	20,1	63,4	2,29	70,1	44,6	7,79	191,0	28,8
	AB - 31-49 35-45	10,5	18,9	0,167	459,0	38,4	456,0	18,5	38,4	2,05	55,0	30,4	5,58	131,0	28,8
	B2 - 61-93 70-80	11,6	18,0	0,321	561,0	53,2	698,0	19,5	57,5	2,67	69,5	36,5	6,45	297,0	29,5
	CCa-95-105 90-100	15,5	20,9	0,609	543,0	34,3	653,0	22,5	62,3	2,89	66,8	42,0	6,95	328,0	31,4
accumulative, P 21 meadow–marsh, saline saline, heavy clay	Ad - 0-7 0-7	26,0	34,5	0,902	829,0	104,0	1030,0	45,6	101,0	3,69	103,0	106,0	18,2	1520,0	69,9
	A1g - 7-33 10-20	17,8	13,0	0,606	913,0	109,0	1090,0	47,4	121,0	2,27	130,0	97,8	14,2	3080,0	54,3
	Bg - 33-60 40-50	14,4	15,5	0,336	757,0	104,0	909,0	40,3	107,0	2,42	122,0	89,2	16,8	2520,0	51,9
	G –60-75 65-75	19,5	23,3	0,412	1040,0	102,0	1070,0	40,2	110,0	3,29	116,0	94,1	13,6	4640,0	49,4

As is arsenic. Arsenic has long been used both as a deadly poison and as a medicine, since it has healing and tonic properties. He, like other trace elements, in small quantities is necessary for living organisms and extremely dangerous in high concentrations. The biological role of arsenic is related to the fact that it is chemically close to phosphorus and can replace it in separate biochemical reactions. The phytotoxic threshold of arsenic in soils depends on the particle size distribution and properties-on light, low-humus soils with low absorptive capacity, it is 10-20mg/kg, and on heavy, high-humus with high absorptivity, it can exceed 100mg/kg [12]. MPC of arsenic in sandy and sandy sour soils does not exceed 2; in loamy and clay neutrals-10mg/kg. The arsenic data obtained by us (Table 3) indicates that in the top positions in the meadow-chernozem soil along the profile it is distributed more or less evenly and ranges within 18mg/kg in the B_2 carbonate horizon and slightly higher 21.6, which exceeds the MPC. More than 34.5mg/kg is found in the accumulative zone in the horizon of arsenic hell. In the lower horizons it is significantly less-13.0–15.5mg/kg. This is due to the heavier particle size distribution of the soil and the alkaline reaction of the environment. According to Russian regulations, these soils have a high arsenic content.

Cd is cadmium. Cadmium is known as a toxic chemical element, but recently it has been established that it stimulates the growth of animals and humans in small quantities. The need for cadmium for plants has not yet been established. Cadmium easily enters the plants through the root system, and from the atmosphere into the leaves. The main cause of cadmium toxicity for plants is that it disrupts the activity of enzymes, inhibits photosynthesis and makes it difficult for plants to enter a number of nutrients. MAC of cadmium in soil in different countries ranges from 2 to 5mg/kg, in water (mg/l) 0.05; in feed-1mg/kg of dry matter. According to Il'ina VB and Syso AI [8] in the Novosibirsk Region there is no dangerous entry of cadmium into plants from the soil, which is also confirmed by our data (Table 3). The number of Cd in the soil profile of the studied landscape is small. In the upper soil horizons of the eluvial positions, its content is 0.8, and in the lower horizons it is 0.9 mg/kg, then some decrease occurs. In soil-forming rocks, the amount of cadmium increases in comparison with the middle horizons. There is an increase in cadmium in accumulative positions.

Ba is barium. Despite the presence of barium in many plants and animals, its physiological significance has not been established. Due to chemical similarity and antagonism with calcium and strontium, barium is able to displace them from plants. Plants easily absorb Ba, especially from acidic soils, and are able to tolerate its high concentrations. The MPC of barium in soils, food and feed has not been developed, and in drinking water it is 0.1mg/l [16]. As Ilyin VI and Syso AI noted [8] in the Novosibirsk region there may be an excess amount of barium in plants and in living organisms due to its high content in soils and waters. The data we obtained (Table 3) suggests that the Ba content in eluvial positions is high and varies along the profile of the meadow-chernozem soil from 543 in the parent rock to 676mg/kg in the humus horizon A. Significantly higher is its quantity respectively 1040 and 829mg/kg, which indicates leaching and movement of Ba down the catena and accumulation in vegetation and living organisms.

B-bor. The biological functions of boron in plants are associated with the metabolism of carbohydrates, the transfer of sugars through membranes, the synthesis of nucleic acids and phytohormones. However, the mechanism of its action is not fully understood. In the south of Western Siberia there is practically no shortage of plant boron. Soils are rich in this trace element, and an excess of boron is a frequent occurrence here, especially in saline soils [17]. MPC boron in drinking water-0.5mg/l. An excess of boron in the soils of the Barabinskaya Plain is a serious environmental problem, both for plants and for animals and humans. A high concentration of boron in saline soils not only reduces the yield, but also causes boric enteritis, an endemic disease of the gastrointestinal tract in animals and humans. In the studied agrolandscape (Table 3), the boron content in the eluvial position is 38–57.8mg/kg of soil, and in the accumulative position, it is 2 times higher in the profile of the meadow-marsh saline soil, which creates serious sanitary and epidemic problems for this area of residence [18].

Mn is manganese. Manganese provides redox processes in plants, since it is able to change valence easily and reversibly transfer from Mn^{2+} to Mn^{7+}. With a shortage or an excess of Mn, these functions are violated [12,19,20]. In plants, manganese is involved in the respiratory process, nitrogen metabolism, promotes the formation of chlorophyll and the synthesis of nucleic acids. In living organisms, manganese performs the same functions as in plants, but at the same time new, specific ones appear. It is needed for the body to produce insulin, the formation of the skeleton, the work of the central nervous system. According to Ilyin VB and Syso AI [8], in the Novosibirsk Region there are areas with both low manganese content and high, and anthropogenic impact on agricultural landscapes can increase both the deficit and excess of this element. Our studies have shown that in the eluvial positions of saline agrolandscape in the profile of meadow-chernozem soils, the gross Mn content does not exceed 855mg/kg, which is lower than the regulated sanitary and hygienic standards adopted in the soils of Russia (1500-3000mg/kg). In accumulative positions in the profile of meadow-marsh saline soil, the manganese content is somewhat higher-up to 1090 mg/kg in horizon A_1. However, the ratio Fe/Mn is high and significantly exceeds the standard (1.5-2). This gives reason to consider this area unfavorable for the cultivation of cultivated plants (Table 4), because manganese deficiency is added to other adverse conditions.

Table 4: Fe/Mn ratio in the studied soils.

Meadow and chernozem ordinary			Lugovo-bolna solonic acid		
Horizon	**Sampling Depth (cm)**	**Fe/Mn**	**Horizon**	**Sampling Depth (cm)**	**Fe/Mn**
A_1	3-18	23.5	A_d	0-7	39,4
A_{11}	18-30	27.9	A_1	10-20	32,4
AB	35-40	39.7	B	40-50	39,3
B_{2Ca}	70-80	27.1	C	60-70	53,6
C_{Ca}	95-105	29.2			

Cu-copper. Copper is involved in many physiological processes occurring in living organisms. In plants, these include photosynthesis, hemoglobin synthesis, respiration, redistribution of carbohydrates, etc. Such wide participation of copper in plant life is associated with its ability, as well as Fe, Mn, Co and Mo to change valence. Copper, like zinc, is responsible for reproductive functions. Its lack leads to a decrease in grain and its quality.

In Russia, MPC of copper for soils is set depending on its particle size distribution and pH value. In sandy and sandy soils, the MPC of gross copper content is 33; in loamy and clay sour-66; loamy and clay neutral and alkaline-132mg/kg. As can be seen from (Table 3), the gross copper content in the eluvial position in the profile of meadow-chernozem solodized soil ranges from 18.5 in horizon AB to 28.5mg/kg in horizon A. and more times more, which indicates the spatial movement of this element from the top to the bottom where it accumulates. Copper content below MPC is typical for all horizons of the studied soils.

Cr-chrome. Chromium, as a chemical element, is vital for living organisms, since in the processes of carbohydrate metabolism, it interacts with insulin, participates in the structure and function of nucleic acids and, possibly, the thyroid gland. The chromium content in plants ranges from 0.02-1.0mg/kg of dry matter. As a rule, plants under normal conditions do not lack it. MPC for chromium in Russia has not yet been developed. According to Kloke A [15], the MPC in animal feed should not exceed 20mg/kg. In drinking water in Russia, the MPC is 0.05mg/l. Researches by Ilyin VB and Syso AI found that no high and dangerous concentrations of chromium were found for the health of animals and humans in the soils of the Novosibirsk Region [8]. Our studies have shown that in eluvial positions, the gross chromium content in the meadow-chernozem soil is below the MPC. According to the profile, its quantity changes insignificantly and only in the horizon of AV it decreases sharply, which, apparently, is connected with the processes of podzolization and lassival. In accumulative positions in the profile of a meadow-swamp soil, the chromium content increases and is on the verge of the MPC or slightly above it, especially in the A1 horizon-121mg/kg, which may be due, on the one hand, to the movement of this chemical element with surface and underground waters, and on the other-with its accumulation due to the periodic flood of Lake Chany during the flood season.

Mo-molybdenum. As an element with variable valence, molybdenum in living organisms performs the function of electron carrier. In plants, molybdenum takes part in nitrogen exchange. It is a catalyst in the conversion of nitrites to nitrates, ensures the fixation of atmospheric nitrogen by nodule bacteria of legumes. The optimal ratio of Cu/Mo=4: 1. With a higher ratio, grazing diarrhea syndrome appears in cattle. As evidenced by the results of the research of Il'in VB and Syso AI, in the soils and plants of the Novosibirsk Region both a deficiency and an excess of molybdenum are possible. Its content in feed and plants below 0.2-2.5mg/kg of dry matter is considered critical, and non-dangerous-10mg/kg. The MPC in soils is 5mg / kg [15]. Our research suggests that the molybdenum content in both the top and bottom positions is low and well below the MPC-from 3.6 to 2.05mg/kg (Table 3). It is about the same and its accumulation in the accumulative positions does not occur. However, there is a high ratio between Cu/Mo-up to 20 (Table 5). Consequently, in this natural landscape, the balance between copper and molybdenum is disturbed, which can cause diseases in animals and people.

Table 5: Cu/Mo ratio in catena soils of the saline natural landscape.

Meadow and chernozem ordinary			Lugovo-bolna solonic acid		
Horizon	Sampling Depth(cm)	Cu/Mo	Horizon	Sampling Depth(cm)	Cu/Mo
A_1	3-18	8,4	A_d	0-7	12,3
A_{11}	18-30	8,8	A_1	10-20	20,9
A_B	35-40	9,0	B	40-50	16,6
B_{2Ca}	70-80	7,3	C	60-70	12,2
C_{Ca}	95-105	8,0			

(Table 5) Cu/Mo ratio in catena soils of saline natural-V-vanadium. Vanadium is a necessary chemical element for living organisms, and for plants its significance remains unexplained. In plants, vanadium contains a little-up to 2mg/kg of dry matter, whereas in soils it is quite a lot. Vanadium was found to be involved in plant photosynthesis. With its lack of plants, the amount of chlorophyll is reduced. Like molybdenum, vanadium is a catalyst in the processes of nitrogen fixation from the air by nodule bacteria of legumes of the plant landscape In the Novosibirsk region in the diets of animals neither vanadium deficiency nor phytotoxicity is observed. According to Kloke A [15], the MPC of vanadium in soils is 100mg/kg; in Russia-150mg/kg, for food-5mg/kg and for drinking water-0.1mg/l. Our data indicate that the content of vanadium in the upper positions of catena in the profile of meadow-black earth soils varies from 55.0 to 70.1mg/kg. The profile distribution of vanadium is more or less evenly, except for the horizon AB, where a decrease in its content is observed. In accumulative positions there is its accumulation, but in quantities much smaller MAC. The maximum content of vanadium falls on the A1 horizon of the meadow-marsh saline soil and is 130mg/kg (Table 3).

Zn is zinc. Zinc is involved in many functions of living organisms. It is part of various enzymes involved in the metabolism of carbohydrates, proteins and phosphates and in the reproduction process. In higher plants, Zn, as a rule, accumulates in the seeds, where it is concentrated in the germ. The MPC of zinc in soils according to Kloke A [15] is 300mg/kg. In Russia, depending on the granulometric composition of the APC (gross) zinc in sandy and sandy soils-65; in loamy and clay (acidic)-110; in loamy and clay (neutral)-220mg/kg. In the studied agrolandscape, the total zinc content in eluvial positions ranges from 30 to 50mg/kg, which is significantly lower than the MPC. In the upper horizons it contains up to 50mg/kg (Table 3). In the horizon AB its quantity decreases and in the parent rock it increases again to 42mg/kg. In accumulative positions, the zinc content increases almost 2 times. Its maximum amount is typical for the upper horizon A. The bottom of the Ziz content is Zn, but the decline is weak.

Co-cobalt. It is established that cobalt has a positive effect on the growth and development of plants and ensures the ability of leguminous crops to capture molecular nitrogen from atmospheric air. In addition, cobalt is part of provitamin B_{12}, which is formed in plants and is necessary for animals and humans. It is established that if the cobalt concentration is reduced to 0.1mg/kg of dry matter and lower, the use of cobalt fertilizers gives a positive result. Co deficiency in soils can cause carbonate, alkalinity, including podzolization and solubility, as well as a high content of humus, iron oxides and manganese. MPC of this element in soils-50mg/kg, in drinking water-0.1mg/l, in feed-10mg kg of dry matter. In the studied saline agrolandscape (Table 3), no excess of cobalt was found in the soils. In the eluvial positions in the profile of the meadow-chernozem soil, its maximum amount falls on the upper humus horizons A1 and A1-8.5-7.8mg/kg, in the horizon AB-decreases to 5.8, and then its content again slightly increases. On alluvial positions in the profile of meadow-marsh saline soil, the amount of gross Co is almost 2mg/kg falls on the upper horizon of Hell, which can be explained by the movement of Co from upper positions to lower ones with surface and subsurface waters. The cobalt content in the studied soils is significantly lower than the MPC.

Sr-Strontium. Gross strontium is a toxic chemical element for plants and animals. In addition, it can cause a negative effect. For example, iodine in the presence of strontium becomes inaccessible to living organisms in which iodine deficiency begins to develop, with all the negative consequences that follow [21]. Currently, MPCs for strontium have been developed for drinking water up to 2mg/l [16]. For soils, MPCs of strontium have not been established, but according to the studies of Kovalsky VV [21], 600mg/kg should be considered a critical level of strontium content in the soil. The strontium - calcium balance expressed by the Ca/Sr ratio in the most prosperous areas, for example, in the Kursk Region is 200, and in the endemic areas of the Amur Region it decreases to 3.5. According to the data of researchers [8,22,23], the saline soils of the Barabinskaya plain contain high amounts of Sr, which is an antagonist of Ca. The results of our early studies convincingly indicate that the distribution of the total strontium content is characterized by its accumulation in accumulative positions and a decrease in eluvial concentrations [24]. Our data are consistent with the results of previous researchers. From (Table 3) it can be seen that on the eluvial position, the content of strontium in the upper horizon is 233mg/kg. In the AB horizon, it decreases to 131, and in the parent rock again increases to 328 mg/kg. In the accumulative position, its amount increases many times. Maximum-4640mg/kg-accounted for the parent rock. Such amount of Sr indicates its high content in the territory of the saline natural landscape. It was established that the average Ca/Sr ratio in the soils of the Barabinskaya Plain is 26-52. In the area under study, it also fluctuates within the same limits (Table 6). This ratio between Ca/Sr indicates a significant imbalance of their content in the soil and in plants. An increase in strontium concentration in soils is one of the main factors increasing them in plants and then in animals and humans. The optimal balanced ratio of Ca/Sr in feed and food is considered to be 80 [24].

Table 6: Ca/Sr ratio in soils of a saline agrolandscape of the southern part of the Prichanovskaya depression.

Meadow and chernozem ordinary			Lugovo-bolna solonic acid		
Horizon	**Sampling Depth(cm)**	**Ca/Sr**	**Horizon**	**Sampling Depth(cm)**	**Ca/Sr**
A_1	3-18	42	A_d	0-7	39
A_{11}	18-30	44	A_1	10-20	32
A_B	35-40	23	B	40-50	39
B_{2Ca}	70-80	103	C	60-70	54
C_{Ca}	95-105	80			

Ni-Nickel. The need for this chemical element for the life of living organisms has been recently established [8]. It is indispensable in the composition of urease and is consumed by bacteria of legumes, stimulates the processes of nitrification and mineralization of nitrogen compounds, positively affects the activity of nitrate reductase, which contributes to the recovery of nitrates and nitrogen fixation. In living organisms, nickel is involved in the structural organization of DNA, RNA and proteins [25-26]. In the Novosibirsk region, there is no natural shortage or excess of this chemical element for plants and animals.

The Regulated Nickel Content in the Soils of Russia is as Follows

APC in sandy and sandy soils-20; in loamy and clayey (sour-40); in loamy and clay (neutral)-80mg/kg. MPC for plant products in feed grain-1, in coarse and succulent feeds-3 mg/kg of dry matter. MAC in drinking water in many countries of the world is 0.1mg/l. In the studied saline natural landscape, the nickel content in the soils of the catena under consideration is significantly lower than the established JDC. At the eluvial position in the meadow-chernozem soil, the nickel content is more or less evenly distributed over the genetic horizons, while at the accumulative position its content increases almost twice, especially in the upper horizon of the hell meadow-marsh saline soil up to 70mg/kg, gradually decreasing with depth, reaching 49mg/kg in the C horizon. The obtained data convincingly indicate that nickel is easily washed away by surface waters from the soil profile of the upper landscape positions to the lower ones and accumulates in the upper soil horizons.

Conclusion

a) A profile study of the macro-and microelement chemical composition of soils was carried out in one of the EPA of a saline agrolandscape in the southern part of the Prichanovskaya depression by catena, in which eluvial (upper) and accumulative (lower) positions were distinguished. At the top position, the soil is represented by a meadow - chernozem plain poorly malignant, and at the bottom - by a meadow – marsh salt marsh.

b) The study of the content of Si, Fe, Al, Ca, Mg, Na, and P macronutrients showed that silicon prevails in both eluvial and accumulative positions, but its eluvial positions are 2 times higher than in accumulative ones. In both soils, the Ca content predominates over the Mg content, especially in the carbonate horizons of the lower position, where conditions are created for its accumulation in a biogenic way. The Na content in the upper horizons of the meadow-chernozem soil exceeds the Ca content.

c) Mg and slightly less than in the hell and A horizons of the meadow-marsh soil due to the periodic flushing of these horizons.

d) In the lower positions of the salted agrolandscape, more microelements accumulate (2-3 times or more) than in the upper positions due to their movement with surface and groundwater. Basically, their content is below the established MPC, which indicates the absence of natural pollution by them. The exceptions are trace elements-arsenic, barium, bromine, and strontium, whose content is several times higher than the MPC. Especially dangerous for animals and humans is the low Ca/Sr ratio in the soils of this region, both in eluvial (23-103) and accumulative (21-39) positions at a rate of 200. Therefore, it is necessary to take measures to increase the Ca content or decrease Sr in soils.

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