ISSN NO: 2770-2367
Date of Publication: 14-09-2022

Effect Of Cadmium Element On The Ecological Status Of Irrigated Soils In Nishan District

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Annotation: The article presents data on the accumulation, excess of the maximum permissible concentration of cadmium in irrigated sierozem-meadow, desert-sandy, as well as gray-brown-meadow soils of the Nishan district of the Kashkadarya region.

Key words: Irrigated serozem-meadow, desert-sandy, gray-brown-meadow soils, cadmium, trophic chain, humus, nutrients.

Relevance of the topic. In the early days of man's appearance on earth, the negative effects of his influence on nature were eliminated as a result of nature's ability to self-renew and regenerate. This feature is due to the fact that water, soil, atmospheric air, flora and fauna fully perform such a vital function as the assimilation, decomposition, processing and complete neutralization of substances that are alien to nature. But then the growth of the population, of its material and spiritual needs, led to an increase and expansion of its power and scope of influence on nature.

The flora has been unable to absorb and process the toxic gases emitted by industrial enterprises, vehicles and human activities in general, the soil has been unable to neutralize the toxins used in agriculture, the fauna has been unable to live in the poisoned and polluted environment. Eventually, so-called "global environmental problems" emerged that made it impossible for human society, which once considered itself capable of solving all problems, to find and solve such problems. [2].

The country pays great attention to environmental protection and rational use of natural resources, conducts extensive research on reducing the movement of toxic toxins in irrigated soils along the soil-water-plant trophic chain, reducing their amount using biological methods and increasing soil fertility. In Decree No. PF-5853 of October 23, 2019 "On approval of the Strategy of agricultural development of the Republic of Uzbekistan for 2020-2030"» [3] sets tasks on "improvement of the system of rational use of natural resources and environmental protection, providing for the rational use of land and water resources, forest resources". This decree provides for the efficient use and increase of fertility of soils used in agriculture, as well as the improvement of the ecological condition of soils.

Level of study of the topic. The high phytotoxicity of cadmium from heavy metals is explained by its closeness to the chemical properties of zinc. Therefore, cadmium can be manifested in the place of zinc in many biochemical processes by disrupting the activity of enzymes involved in

ISSN NO: 2770-2367
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respiration and other physiological processes, such as carbonic anhydrase, various dehydrogenases, phosphatases, as well as proteinase and peptidase involved in protein metabolism, nucleic metabolism enzymes and others. As a chemical analogue of zinc, cadmium can take its place in the enzymatic system necessary for the process of phosphorylation and formation of glucose and the consumption of carbohydrates.

Cadmium is a very toxic element, 5-10 times less than lead in food. Elevated concentrations are observed in cocoa powder (up to 0.5 mg / kg), in animal kidneys (up to 1.0 mg / kg), and in fish (up to 0.2 mg / kg). Cadmium-containing canned products are abundant in tin cans because cadmium, like lead, is used in low-quality glue that contains a certain amount of cadmium in the product.

An increase in cadmium can occur as a result of its entry into the environment. For example, it is used to grow crops or animals in areas contaminated with cadmium [4].

In this case, the risk group includes vegetables, fruits, meat, milk. Wheat contains three times more cadmium than rye. Cadmium accumulates primarily in fungi, many plants (especially cereals, vegetables and legumes, as well as nuts), and animal organisms. Heavy metals enter plants from the soil. Some soils are initially characterized by high levels of cadmium, while others are contaminated with industrial waste or treated with cadmium-containing fertilizers.

The substitution of zinc and cadmium leads to zinc deficiency in the plant organism, which in turn leads to damage and even death of plants. Plants can be arranged in the following upward order in terms of exposure to cadmium: tomatoes <oats <lettuce <grasses <carrots <radishes <beans <peas <spinach.

According to its chemical properties, cadmium is related to zinc, which can replace zinc in a number of biochemical processes in the body, for example (as a false activator of proteins). A dose of 30-40 mg can be fatal to humans. The peculiarity of cadmium is its long-term retention time: about 1% of the administered dose is eliminated from the body within 1 day [5].

The aim of the study was to determine the amount of toxic elements in irrigated soils and their impact on the soil environment, ecological and agrochemical condition.

The object of the study was selected irrigated serozem-meadow, desert-sandy and brown-meadow soils in Nishan district of Kashkadarya region.

The subject of research is irrigated soils, nutrients, heavy metals, the ecological condition of the soil.

Research methods. The studies were conducted in the field and in the laboratory conditions. This was done on the basis of methodological manuals such as "Methods of agrochemical analysis of soil and plants", "Methods of agrophysical research", "Methods of field experiments." Humus detected with Tyurin method, nitrogen Keldal method, general form phosphorus Ginzburg method, potassium Smitt method, mobile nitrate nitrogen ionoselective method, ammonium nitrogen with Nessler reagent, phosphorus Machigin method, potassium flame photometric chromatography method, and heavy metals detectes with atom-absorbion method in the apparatus.

Research results. The territory of the farmers' association of Uch Mola massif of Nishan district is located in the area of serozem soils, where irrigated serozem-meadow soils are distributed. The mechanical composition of these soils consists mainly of light sands. This is mainly explained by the predominance of smalller soil particles > 0.25 in size in the soils. These values are 10-15% in serozem-meadow soils (section 13), 8-13% in virgin desert-sandy soils (section 1), and the highest rate in gray-brown soils is found in section 2. It is explained by the fact that it is at 18.5-23,5% of all particles. The highest values of fine sand particles were found in desert-sandy soils, with 67.4% (cross-section 1) in the arable layer, 65.5% towards the lower layers, and fine sand particles predominating in massive soils. In irrigated gray-brown soils it is 64.1-61.6%.

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In the “Uch Mola” massif of Nishan district, irrigated serozem-meadow, desert-sandy and brown-meadow soils are spread, and the average humus content in the developed desert-sandy soils is 0,250-0,448%. The total nitrogen content is very low, around 0.026-0.048%. Total phosphorus was 0.072-0.126% and total potassium was 1.17-1.99%.

The amount of phosphorus in the lower layers of these soils from 50 cm varies from 0.116% to 0.098%. The mobile form of nitrogen, N-NO_3, was 31.8–53.1 mg / kg in the topsoil layer of the soil, while it was lower in the sub-soil layer of the soil, 18–25 mg / kg. The amount of mobile P_2O_5 was also observed in the topsoil layer of the soil and decreased in the subsoil layer. The amounts of exchangeable K_2O were around 140–294 mg / kg, and in the subsoil layer of the soil, these values were lower, i.e., 130–254 mg / kg.

The amount of mobile nitrogen (N-NO3) was found to be 20.1-53.1, phosphorus - 20.0-80.0, and potassium 231 mg per kilogram of soil. It can be seen that these soils are low and moderately supplied with mobile nitrogen, phosphorus, and moderate to high with potassium.

Irrigated brown-meadow soils are distributed in the described massif, and the amount of humus in the topsoil layer is higher than in other soils - 0.352-0.654%.

The total nitrogen content varies from 0.044% to 0.076%. Similarly, total phosphorus and total potassium are relatively high, with phosphorus 0.092–0.162% and total potassium 1.16–1.95%.

Nitrogen in the mobile form varies in the amounts of N-NO_3 20.1-49.0, P_2O_5 15.2-60.0 and K_2O 240.0-394.0 mg / kg. Such cases mean that the fertilizer was given irregularly. In the massif "Uch Mola" there are light serozem meadow soils. However, these soils are also 0.290-0.341% which poor in humus. The total nitrogen content is also very low (0.024-0.034%), the total phosphorus is 0.082-0.102% and the total potassium is 1.18-1.35%, i.e. it does not differ from the amount in desert soils. The amount of nutrients in the mobile form differs little from that of previous soils. Mobile nitrogen N-NO_3 was 31.1-35.5 mg / kg, mobile phosphorus -5.0-15.0 mg / kg and exchangeable potassium 260.0-331.0 mg / kg. The large difference between the minimum and maximum amounts indicates that local and mineral fertilizers are not applied uniformly.

Humus and nitrogen are more in the topsoil layer, and decrease sharply in the bottom layer.

Therefore, the amount of nitrogen in the driving layer in the mobile form (NO_3-N) is higher and decreases towards the lower layers. The topsoil layer is mostly low and moderately supplied with mobile nitrogen. The amount of mobile nitrogen depends on the organic and mineral fertilizers given.

The degree to which these soils are supplied with mobile nitrogen varies greatly. It ranges from 5 milligrams to 34.0 mg per kilogram of soil. However, large areas of land fall into the low-income category.

Irrigated weakly saline serozem-meadow soils of “Uch Mola” massif of Nishan district are poorly supplied with humus, 0.202% towards the lower layers, 0.038% of the total nitrogen to the lower layers, 0.095-0.68% of the total phosphorus, total potassium, while from 1.24% to 0.88% in the lower layers.

Soils with mobile nitrogen are moderately supplied (20-30 mg / kg), with 35.13 mg / kg in the first layer, 24.13 mg / kg in the second layer, and 13.67-8.55 mg / kg downstream from the third layer, decreases. Mobile phosphorus was also found to be around 18.87 mg / kg in the first layer, lower than the supply level (15–30 mg / kg), and decreased to 12.67–7.70 mg / kg towards the lower layers. Potassium was observed to be low in all layers (around 190–145 mg / kg).

In irrigated grey brown-meadow soils, the humus content was 0.558% in the first layers and decreased to 0.424% in the lower layers. The agrochemical condition of the soil was found to be slightly better than that of the serozem-meadow soils (1-table). This is because humus, nitrogen, phosphorus, and potassium have been found to be characterized by low and moderate supply of nutrients in general and mobile forms

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Table 1
Nutrient supply of soils in the Uch Mola massif of Nishan district
(average of layers depending on salinity of sections)

Depth	**Humus, %**	**Total, %**			**C:N**	**Mobile, mg/kg**		
		N	**P**	**K**		N-NO_3	P_2O_5	K_2O
Irrigated serozem-meadow, low saline. 11, 12, 13-sections								
1	0,438	0,038	0,095	1,24	6,7	35,13	18,87	190
2	0,395	0,033	0,089	1,15	6,9	24,13	12,67	172
3	0,365	0,027	0,079	1,01	7,8	13,67	9,37	157
4	0,292	0,020	0,068	0,88	8,5	8,55	7,70	145
Irrigated sandy, low saline. 1, 2, 8-sections								
1	0,451	0,038	0,083	1,52	6,9	34,87	28,80	210
2	0,362	0,034	0,077	1,35	6,2	24,53	20,60	196
3	0,327	0,029	0,068	1,23	6,5	12,80	13,30	180
4	0,248	0,025	0,058	1,07	5,8	8,85	10,65	172
Irrigated grey brown-meadow, low saline. 3, 4, 7-sections								
1	0,454	0,045	0,151	1,51	5,9	30,4	23,2	215
2	0,428	0,042	0,119	1,33	5,9	22,3	14,6	203
3	0,400	0,041	0,100	1,08	5,7	13,4	10,0	195
4	0,382	0,036	0,082	1,16	6,2	6,50	8,30	187
Irrigated grey brown-meadow, average saline. 5, 6-sections								
1	0,558	0,049	0,111	1,97	6,6	34,15	20,15	267
2	0,485	0,042	0,092	1,57	6,8	25,70	16,65	242
3	0,504	0,041	0,072	1,35	7,1	18,0	11,50	207
4	0,424	0,034	0,068	1,30	7,2	9,70	8,9	184
Irrigated grey brown-meadow, non saline. 10-section								
1	0,448	0,038	0,106	1,22	6,8	30,90	15,20	254
2	0,385	0,034	0,098	1,15	6,6	26,20	12,60	223
3	0,325	0,028	0,082	1,06	6,7	20,40	10,40	210

The mobile potassium in the topsoil layer varies up to 415 mg per kilogram of soil. However, the main land area is moderately supplied with mobile potassium.

In the “Uch Mola” massif of Nishan district, the average content of cadmium in irrigated serozem-meadow soils decreased from 0.10 mg / kg to 0.06 mg / kg in the lower layers. This element averages 0.14 mg / kg in 0-2 cm layer, 0.11 mg / kg in 2-10 cm layer, 0.14 mg / kg in 10-20 cm layer, 0 in 20-30 cm layer in desert-sandy soils. 11 mg / kg and was observed in the range of 0.13 milligrams towards the lower 30-50 cm layer.

7 main cross-sections were obtained from the grey brown-meadow soils. According to the results of the average analysis, 0.09 mg / kg of cadmium element in 0-2 cm layer, 0.08 mg / kg in 2-10 cm layer, 10-20 cm layer 0.09 mg / kg, 0.08 in the 20-30 cm layer and 0.06 mg / kg in the 30-50 cm layer, respectively (Figure 1).

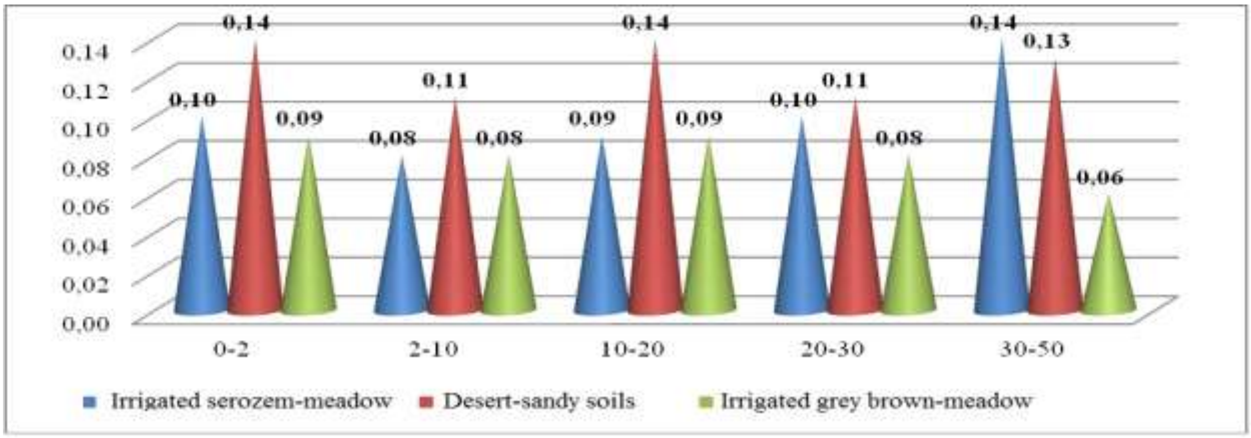

Figure 1. The average amount of cadmium (mg/kg) in the soils of the Uch Mola massif of Nishan district

The amount of cadmium is less than the allowable norms and does not adversely affect the bioecological condition of these soils. Its distribution across the soil section was quite flat and was observed to be around 0.14–0.06 mg / kg.

The PN of cadmium in the soil is 0.5 mg/kg, and according to H.Chuldjiyan and others, it is 1.0 mg/kg [1]. Therefore, the results of current scientific research should be developed on the basis of experiments "The accepted norms of heavy metals that meet all the specific requirements for each soil type and cultivated plant in the country" - writes the professor [6]. On the gradation (transition from the first stage to the second stage) constructed by H.T. Riskieva for moving heavy metals I. 0.3-0.5 II. 0.5-0.7; III. 0.7-0.9; IV. 0.9-1.1; V. 1,1-1,3; VI. 1.3–1.7 mg/kg has been shown [7].

Conclusion

Based on the results of the study, it was found that the irrigated soils of the studied area are mainly low and moderately supplied with nutrients. It can be seen that the contamination of the soils of this region with the element cadmium is less than the permissible norm. In these studied soils, a decrease in the cadmium element from the top to the bottom layers was observed, which indicates that the cadmium element is accumulating under the influence of anthropogenic factors.

The population of the studied area can be considered to be constantly infected with new types of diseases, and the emergence of new types of diseases can be considered as the accumulation of heavy metals and various toxic elements in the soil, along with polluted air and exhaust gases.

Enrichment of soil with organic fertilizers, improvement of soil environment, proper introduction of crop rotation, preservation of green layer of soil, wide use of green manure, improvement of physical and chemical properties of soil in general are factors that protect soil and environment from pollution.

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