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Development and Increase of Fertility of Irrigated Sandy and Loamy Soils of Bukhara Region

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Annotation: Research is being conducted in the world on the efficient use of land resources by determining the level of fertility, taking into account the formation and development of irrigated soils, the laws of evolution, changes in soil properties under the influence of irrigation. This article also pays special attention to the development of irrigated sandy and loamy soils of Bukhara region, improving their ecological and reclamation status, selection of crops suitable for soil and climatic conditions, quality assessment and application of information technology in soil management.

Keywords: Soil fertility, sandy-desert, sandy soil, meadow-alluvial, meadow-swamp agroecosystem, erosion, biogeocenosis, anthropogenic landscape, degradation, groundwater, salinity, deluvial-proluvial, gypsum layer.

Introduction: Today, "1,500.0 million hectares of land are used for agricultural production in the world. Of this, 400.0 million / ha of high-quality lands, 800.0 million / ha of good quality lands and 300.0 million / ha of low-quality (marginal) lands"[1]. Therefore, one of the urgent issues is to restore and increase the productivity of agricultural lands, taking into account the various adverse changes that occur under the influence of natural or human activities. The Action Strategy of the Republic of Uzbekistan for 2017-2021 states that "... continuous development of agricultural production, further strengthening of food security, further improvement of irrigated lands, reduction of cotton and grain fields, further optimization of arable lands The remaining lands will be planted with potatoes, vegetables, food and oilseeds"[2], as well as new intensive orchards and vineyards. In this regard, it is important to determine the properties of irrigated soils in different soil and climatic conditions of the country, to prevent negative processes in irrigated soils under the influence of various factors, to improve soil quality assessment and determine the level of fertility. Currently, in Bukhara region, research is being conducted to assess the quality of irrigated lands, maintain and increase their fertility, the use of new technologies in the effective use of low-yielding lands, and certain results are being achieved.

The purpose of the article: to develop recommendations for the efficient use of soils based on the study of the properties of irrigated sandy desert soils of Bukhara region.

[1] http://www.fao.org/3/a-i1688r.pdf
[2] Decree of the President of the Republic of Uzbekistan No. PF-4947 of February 7, 2017 "On the Action Strategy for further development of the Republic of Uzbekistan"

The object of study is irrigated sandy-desert, meadow-alluvial soils of Bukhara region.

The subject of research is soil properties, soil fertility, grading coefficients, soil quality assessment.

Research methods. The research was carried out in accordance with the generally accepted standard methods in soil science, as well as in the latest edition of the "Guidelines for conducting soil surveys and compiling soil maps for maintaining the State Land Cadastre." Mathematical-statistical analysis of the obtained data was calculated on the basis of the method of variance statistics (B.A. Dospekhov).

The area within the administrative boundaries of Bukhara region is 4183.1 thousand hectares, of which 226.6 thousand hectares of irrigated land for agriculture, ie 5.42% of total land [3.3; 6 b., 2.88;]. The region is located in the south-western part of the country, bordering Navoi region in the north, Kashkadarya region in the east, the Republic of Turkmenistan in the south, Khorezm region and the Republic of Karakalpakstan in the west [1.3;]. The main part of the total irrigated lands in the territory of Bukhara region, ie 69.1% of meadow alluvial soils, 9.5% of brown and light brown meadow soils, 7.9% of barren-meadow and meadow-barren soils, 3.7% of barren soils and the remaining 9.8 percent is composed of sandy-desert, desert-meadow, meadow, and marsh-meadow soils. Irrigated sandy desert soils of Bukhara region are located mainly in the lower reaches of the Zarafshan River, in the Bukhara and Karakul deltas, as well as in the adjacent ancient proluvial-alluvial plains and the tertiary Kyzylkum plateau. In the Bukhara delta there is a river slope and two terraces. The first of them is located on both banks of the river from a few meters to 2 km wide. It is composed of layered flowing muds consisting of light sand, gravel, and sand. A fine layer of soil is covered with gravel. Groundwater is located at a depth of 0.5-2 m. The rest of the Bukhara delta is located on the second terrace of Zarafshan and is divided into upper, middle and peripheral parts. In the upper part of the delta, the gravels are located at a depth of 2-5 m. The salinity of groundwater is 1.5-3 g / l. The middle part of the delta consists of layered alluvial effluents, which are covered with gravel at 5-10 m. Groundwater is located at a depth of 1-3 m, their salinity - 5-10 g / l. In large areas of the delta, alluvial deposits are covered with agroirrigation deposits with a thickness of 0.5-1 m and more. According to the conditions of groundwater flow in the Bukhara delta, it belongs to the group where groundwater flows less than a certain area, which leads to an increase in groundwater and increased salinity. This process is due to the deterioration of groundwater runoff from the upper part of the delta towards the periphery. According to the lithological and geomorphological structure of the Karakul subaerial delta of the Zarafshan River, it to some extent repeats the Bukhara delta. At the same time, it also consists of two terraces, but the first is weakly represented and is mainly conditionally separated. The second terrace occupies the main part of this delta. It consists of thick sand-sand alluvial deposits, which alternate with sand-clay-clay-sand deposits at the margins. In most parts of the delta, alluvial deposits are covered with agroirrigation sediments. Depth of groundwater is in the range of 1-3 m. Here the salinity of groundwater increases from 2-5 to 3-7 g / l from the top to the bottom. The ancient spread of Zarafshan enters the Kyzylkum and covers the present-day Bukhara delta in the north and northwest. It is composed of alluvial deposits subjected to strong wind erosion processes. In the alluvial weak thickness (0.5-3 m) covering the base rock. The base rock is exposed in some cases. Part of the ancient delta, which borders the Bukhara oasis, is developed in irrigated agriculture. Groundwater is located here at different depths (from 1 to -5 m). Their salinity varies from 2 to 5 g / l and more. In the north-east, the irrigated zone rises to the deluvial-proluvial plain, which is composed of shallow-grained sandstone and sandy deposits with fine-grained joints, and in the south-west - to the tertiary plateau and the old alluvial

plain. Groundwater is located here at a surface of 3 m. The irrigated zone of Bukhara region is a subtropical hot desert zone of the Central Asian soil-climatic province. In Bukhara region there are irrigated automorphic, transitional and hydromorphic soils of the desert zone, which are composed of deposits of different genesis and age.

Nutrient supply of soils of Fayoz farm, Bukhara massif, Jondor district, Bukhara region

Table 1:

Contour №	Incision №	Depth , см	Humus %	P2O5 mg/100g	K2O mg/100g	NO3-N mg/100g
488	1	0-35	0,6308	4,60	16,10	0,362
		35-52	0,5644	3,30	4,13	0,458
		53-71	0,2709	2,18	3,30	0,408
		71-125	0,1505	1,30	4,10	0,242
		126-170	0,1505	1,18	6,60	0,202

Sandy-desert soils are composed of sands that are tightly bound to the sedimentary vegetation that forms the grass layer. The color of humus is observed at a thickness of 25-30 cm. In this layer all the humus is concentrated. Its content in this layer is around 0.5%, nitrogen 0.04-0.05%, total phosphorus 0.14-0.15%. Groundwater is located at a depth of more than 5 m. These soils are also not widespread in the province. Most of the existing soils are distributed in the newly developed areas of Shafirkan, Peshku, Jondor, Karakul and Alat districts. In recent years, when water shortages have been felt, most of these areas have not been used for agricultural irrigation. Salinity is weak and increases to a moderate level. Long-term irrigation causes groundwater to rise to 2-3 m, which leads to changes in the hydrothermal regime of sandy desert soils and their transition (transformation) to desert-meadow soils. Poor in humus and nutrient reserves.

Humus in irrigated sandy-desert soils, the amount of essential nutrients

Table 2

Incision №	Depth , см	Humus, т/га	Nitrogen, т/га	General		Moving	
				phosphorus т/га	potassium т/га	P_2O_5 кг/га	K_2O кг/га
DB-120	0-30	19,29	1,31	3,72	64,71	57,42	1077,12
	0-50	27,65	2,01	5,48	102,83	68,64	1607,10
	0-100	47,87	3,74	9,77	186,21	113,08	2899,60

PK-140	0-30	20,75	1,50	3,56	71,87	34,06	1180,08
	0-50	32,51	2,34	5,64	114,54	52,47	1821,60
	0-100	58,30	4,44	10,21	217,45	93,28	3370,40
ZP-119	0-30	29,70	2,10	3,48	68,43	39,60	1112,76
	0-50	41,58	2,97	5,28	104,74	56,43	1633,50
	0-100	69,96	5,10	9,59	185,46	99,00	2895,20
МЖ-130	0-30	16,24	1,23	2,69	62,05	42,77	1005,84
	0-50	24,09	1,78	4,42	98,41	64,02	1432,20
	0-100	42,50	3,21	8,18	179,48	107,80	2666,40
IN-139	0-30	18,93	1,74	2,93	52,59	59,40	914,76
	0-50	29,14	2,44	4,75	83,56	93,06	1399,20
	0-100	55,88	4,40	8,89	148,19	161,92	2631,20
average	0-30	20,98	1,58	3,28	63,93	46,65	1058,11
	0-50	30,99	2,31	5,12	100,82	66,92	1578,72
	0-100	54,90	4,18	9,33	183,36	115,02	2892,56

Due to the fact that the territory of Bukhara region is located in the desert zone, the composition of soil-forming rocks, low humidity, poor vegetation cover and other reasons, the biological and chemical processes in the soil are slow. As a result, the accumulation of organic matter, especially humus, in the soil layers slows down.

Mechanical composition of irrigated sandy-loam soils

Table 3

Incision №	Depth of layer, cm	The amount of soil particles in%, the size in mm							Name on mechanical composition	
		>0,25	0,25-0,1	0,1-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	physical mud (<0,01 мм)	
МЖ-130	0-19	0,18	0,21	41,13	49,98				8,5	sandy
	19-36	0,36	0,32	26,88	63,26				9,18	sandy
	36-78	0,15	0,21	35,74	54,84				9,06	sandy
	78-144	0,16	0,21	37,28	53,67				8,68	sandy
ИН-139	0-21	0,1	0,1	42,34	42,08				15,38	sandy

	21-34	0,1	0,1	42,94	48,76				8,1	sandy
	34-81	0,1	0,2	43,43	44,38				11,89	sandy
	81-153	0,15	0,1	37,92	48,66				13,17	sandy

According to the mechanical composition, the soils are heavy and medium sandy. The amount of humus in the plowed layer of swamp-meadow soils is about 3%. These soils are poor in terms of total phosphorus reserves as well as potassium [8.12; 8-19 b.]. The mechanical composition of soils distributed in the region varies depending on its origin, location, farming system and other characteristics.

Aqueous absorption composition of irrigated sandy-desert soils,
(abs. in% of dry soil weight)
Table 4

Incision №	Depth, см	Dry residue, %	pH	HCO_3	Cl	SO_4	Ca	Mg	Na^+ difference	Salinity (Cl/SO4)	
										indicator	type
МЖ-130	0-19	1,544	7,5	0,012	0,241	0,695	0,166	0,082	0,148	0,35	x-c
	19-36	0,580	7,31	0,012	0,077	0,264	0,064	0,028	0,055	0,29	x-c
	36-78	0,396	7,35	0,006	0,041	0,2	0,042	0,023	0,033	0,21	x-c
	78-144	0,234	7,34	0,006	0,028	0,129	0,03	0,015	0,019	0,22	x-c
ИН-139	0-21	0,31	7,36	0,006	0,024	0,146	0,028	0,015	0,027	0,16	c
	21-34	0,23	7,32	0,006	0,021	0,106	0,02	0,01	0,025	0,20	c
	34-81	0,154	7,31	0,003	0,014	0,088	0,015	0,008	0,020	0,16	c
	81-153	0,102	7,48	0,003	0,009	0,06	0,015	0,008	0,003	0,15	c

Most of the region's irrigated soils are considered to be somewhat saline or prone to salinization. This process, which affects soil fertility, is a characteristic feature of desert soils. According to the latest soil quality assessment, the average score of irrigated lands in Bukhara region has decreased by 7 points over the past 20 years.

Climate. From the agro-climatic point of view, the territory of Bukhara region belongs to the Lower Zarafshan agro-climatic district of the Lower Zarafshan district of Turan province. Much of the area consists of lowlands, flat deserts, and is strongly heated in the summer months. The irrigated lands of Bukhara region are located in the desert and occupy the central part of the Kyzylkum. Due to its remoteness from the ocean and open seas, Bukhara is one of the typical arid countries. Bukhara region is one of the countries in the inland basin, located on the border with the transition from temperate to subtropical. Such a geographical location of the region has a serious impact on the climate. That is, the climate of the region is formed under the influence of dry tropical air in summer, and in winter under the influence of cool air coming from the north, temperate latitudes. As a result of the observations, it was found that the climate of Bukhara region is adapted for the care of irrigated agricultural crops, with some disadvantages. Low rainfall and fluctuations in temperature overnight lead to salinization of the soil surface layer and the occurrence of swamping processes. These processes, in turn, hinder the normal development of agricultural crops. Bukhara region has very arid climatic conditions, characterized by very short and unstable winters, dry, serophthora, hot summers. The average temperature of July (the hottest) is 28-29.6 °, and the average temperature of January (the coldest) is -0.4 (Karakul), -1.5 ° (Shafirkon). In Bukhara region, due to the inflow of strong Arctic air masses and the stagnation of the northwestern air mass blowing from the Siberian anticyclone, the temperature cools down to -25 ° in Kogan and -20 ° in Shafirkan. However, in summer, due to the steep fall of the sun, the air heats up and the temperature rises to + 45 °, so the absolute annual temperature amplitude reaches 74 °. The average annual temperature is 15 0C. The annual rainfall is 125.5 mm, which falls mainly in winter and spring. High temperatures and dryness of the air lead to strong evaporation. Evaporation from the water surface is 2057 mm per year. The bulk of the moisture is observed during the growing season (until September), which corresponds to 1648 mm. It is very important to keep moisture in the soil during this period. Because during the growing season the total temperature is 4500-5600 o C. The onset of freezing of the soil surface occurs on average in October. The last freezing will be observed in April. The small difference in vibration between the soil surface and the air temperature occurs in December and is equal to 0.2 0, the large difference occurs in July and is 7 0 C. In autumn and winter, the difference between the soil surface and the air temperature is not so great. The difference in the temperature of the soil surface overnight reaches 2-2.5 0S. In Bukhara region, precipitation is not evenly distributed across regions and seasons. The annual precipitation in the Bukhara and Karakul deltas is 114-125 mm, and in the surrounding sandy desert it is 90-100 mm. [5.86;].

Research methods: The research methods were carried out according to generally accepted standard methods in soil science in preparation, field, laboratory and chamber conditions. The research used geographical, genetic, natural-historical, comparative, lithological-geomorphological, chemical-analytical and profile methods. Mathematical-statistical analysis was calculated using the variance method using Microsoft Excel.

Analytical studies of the obtained soil samples: 1. Mechanical composition of the soil according to the pipette method of NA Kachinsky; 2. The amount of salts and ions in the soil, the method of water absorption, the degree of salinity - according to L.P. Lebedev; 3. SO4 gypsum - 0.1 n. By HCl absorption method; 4. CO2 carbonates - by Kudrin's ascidimetric method; 5. Humus - in the style of I.V. Tyurin; 6. Total nitrogen - by Keldal method; 7. Total phosphorus - in one sample by Mesheryakov's method; 8. Total potassium - by Mesheryakov's method; 9. Phosphorus and potassium in mobile form - in 1% carbon-ammonium absorption; 10. Absorption capacity of cations and composition of cations - performed on the basis of chemical analysis in the Pfeffer method.

Recommendations: Different climatic conditions and many soil types are prevalent in the territory of the Republic, which makes it more difficult to solve the above problems. In particular, sandy and loamy soils are currently being developed and used in agriculture. In order to assimilate sandy and loamy soils, it is compacted in order to enrich it with fine-grained soil. To do this, the sandy field is fed fine-grained soil effluents, a lot of turbid water. During compaction, turbid particles are released into the top layer of the soil, and some of the colloidal particles are absorbed into the sand. The experience of radically improving sandy soils abroad is noteworthy. For example, in Hungary, 3-4 layers of organic matter are added to the soil. The thickness of each layer is 1 cm, the 1st layer is laid at a depth of 45-65 cm, the 2nd and, if necessary, the 3rd layer is laid 15 cm higher than the previous one after 3 years. When this is done, the roots of the plants in this layer develop strongly and cling to each other. In the development of sandy soils, crop rotation and the application of organic fertilizers, the use of structural polymers are important. In some sandy plots, plants such as sand ermon (shuvok), kumqiyok are planted; then used as pasture. If these plants are sufficiently developed, they will be used to make valuable fodder. In this case, it is necessary to follow a certain regime, ie the order of use of pastures. It is advisable to take measures against wind erosion in these areas. Alfalfa, oats, alfalfa, corn and other fodder, melons and tree crops were planted on the developed lands. [4.203.] At present, on the left bank of the Zarafshan River, in the Malik Desert, Karshi Desert, Surkhan, Sherabad and other deserts, great work is being done in the field of irrigated agriculture for the development of brown soils and sandy desert soils. Increasing the fertility of irrigated sandy and loamy soils depends on the efficient and stratified use of mineral fertilizers.

In order to protect the fertility of irrigated soils and increase the productivity of agricultural crops, we recommend the following measures:

1. In dry years, it is possible to carry out spring wet irrigation, periodic leveling, economical use of irrigation water.

2. In order to increase soil fertility, it is expedient to introduce crop rotation and establish reserve trees.

3. In order to increase the efficiency of fertilizers, composting organic fertilizers with mineral fertilizers, feeding agricultural crops, applying 25-30 tons of organic fertilizers per hectare are highly effective.

4. Ensuring soil fertility and crop nutrients using cover crops

5. The use of cover crops in increasing the porosity and water absorption capacity of the soil

6. Periodic cleaning of collector drainage systems on farms, which increase their efficiency and prevent the rise of groundwater. When grouping soils according to the degree of salinity, attention is paid to the total amount of water-soluble salts and chlorine in them. With increasing salinity, soil quality deteriorates, fertility decreases, and reclamation measures become necessary.

Before sowing in saline soils, it is necessary to carry out the following reclamation measures:

- One of the most important measures to prevent soil salinization is the careful development of water use plans on the basis of rules that fully meet the requirements of agronomy, the transition to a new irrigation system, construction of hydraulic structures from irrigation stations, water conservation, pollution;

- it is possible to remove and improve the salinity of salts and salts of different levels by stopping the continuous rise of groundwater saline through the capillary pathways and removing harmful salts accumulated in the soil; - To improve the physical and chemical properties of soils, it

is necessary to put gypsum on these soils. Its feature is that it removes sodium and calcium from the absorbing complex of the soil, as well as improves the physical condition of the soil; - Measures such as fertilization of loamy and loamy soils, deep plowing of loamy soils, large-scale introduction of irrigation works, digging ditches and reducing their level are the main measures to improve the physical and chemical properties of soil, increase its fertility. If agromeliorative measures are applied in a timely and correct manner, it is possible to plant crops in these soils and obtain consistently high yields from them; Salinity will increase further if the norm of saline leaching water is not taken into account when soil salinity is washed away, the depth and salinity of groundwater. Proper rotation improves the reclamation of saline and swampy soils, increases soil fertility and increases productivity. The reclamation effect of crop rotation is that the soil is fertile, which increases organic and nutrient content, improves physical properties, and moisture evaporates less. [5.157.]

Conclusion: The process of formation of irrigated soils of Bukhara region took place in various complex lithological-geomorphological, hydrogeological, climatic conditions. The area is irrigated meadow, sandy-desert, alluvial-meadow and meadow-swamp soils. Irrigated meadows, sandy-desert soils developed in the tertiary deposits and ancient alluvial plains have been shown to have morphogenetic, agrochemical, ameliorative properties typical of oasis soil types, changing a number of natural features in the process of development and irrigation. The mechanical composition of soils, depending on the nature of the parent rocks that form them, consists mainly of medium, heavy and light sands, and in some cases sands and gravels. It was found that 10.4% of the total irrigated area is sandy and loamy, 14.8% light sandy, 46.9% medium sandy and 27.9% heavy sandy soils. The amount of humus in the driving layer fluctuates in the range of 0.410-1.180%. The amounts of total nitrogen, phosphorus and potassium are 0.033-0.083%, 0.088-0.316% and 0.915-2.210%, respectively, while the amounts of mobile phosphorus and potassium are 8.6-16.8mg / kg and 136-298 mg / kg, respectively. is formed. Humus reserves average 28.87 t / ha in irrigated meadow soils in 0-30 cm layer, 20.98 t / ha in sandy-desert soils, 38.94 t / ha in meadow-swamp soils and 39.24 t / ha in meadow-alluvial soils. and amounted to + 2.38 / + 1.88 / -1.04 / -3.06 tons per hectare, respectively, compared to 2004. Arid climate, complex soil formation process and proximity to groundwater determine the susceptibility of these soils to salinization. 1.07% of the surveyed areas are non-saline (washed), 55.65% are low-salinity, 33.97% are moderately saline, 9.16% are highly saline and 0.15% are very strongly saline.

Accordingly, all lands, whether agricultural or non-agricultural, should be protected. Excessively saline soils always produce less than non-saline soils. Such lands require more labor and money from the state and land users. Therefore, the preservation and continuous increase of land fertility, its rational and efficient use should be considered as an integral part of state land policy, an important part of the country's economic development programs. . [3. 4.] It is not possible to solve the above-mentioned problems without comprehensive rational use of land resources, strengthening measures to protect the soil layer from various erosion and other adverse effects, and without taking measures to conserve agricultural land. . Improving soil fertility depends in many ways on a set of measures aimed at improving it, to treat it with care and economy. With this in mind, it is important to consistently accelerate agricultural production, use land resources wisely, develop solutions to problems related to increasing the productivity of each hectare of irrigated land, its economic efficiency. In this regard, maintaining soil fertility and increasing it annually is an important task for agricultural specialists. It is no coincidence that the state is currently investing heavily in improving

the reclamation of agricultural lands, restoring soil fertility and building reclamation systems, as well as measures to use them.

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