Dependence of microbiological activity of irrigated meadow alluvial soils of Bukhara oasis on soil salinity levels

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Abstract. *The article highlights the importance of biological methods used to increase the fertility of irrigated meadow alluvial soils, and studies the dynamics of enzyme activity of soils applied with fertilizers.*

Keywords. *Soil salinity, irrigated lands, microbiological activity, district, arches, and irrigated lands.*

According to historical sources, these hydraulic structures were used not only for their main function, but also as water separators and water distribution facilities for the designation of irrigation networks in the Bukhara oasis and the distribution of water along the Zarafshan River. For example, in the 16th and 18th centuries, during the irrigation season, 21 of the ponds that passed through the Puli Karmana near Karmana were divided into 10 canals from the Zarafshan canal to the Duoba dam.

From the beginning of the Shohrud canal, water flowed through four arches of the Puli Mehtar Kosim, and were poured to the lands from Somjan district to Tarob. In Puli Chahorminor, seven arches of water were poured, two of which divided between the lands of Shahri Islam, Mohon, Poykan and Kulikalon. The remaining five arches were the khakoba of the Karakul oasis, which was thrown from Puli Jandor to the lower reaches of the river. Obviously, during the period of water distribution, the front of the bridge arches were blocked, and during the discharge of water into the tunnel, they were open. In our opinion, the arches of these structures are simply blocked in the form of a dam by means of branches, such as the Choponota watershed. Thus, Puli Karmana, Puli Mehtar Kosim, Puli Chakhorminor and Puli Jondor, built in the 16th century. They were not only a simple bridge over the Zarafshan River, but also a source of water for irrigation along the Bukhara oasis also served as a structure.

Farmers of the Bukhara oasis paid great attention to washing the saline soils and drying the swamps. The ditches dug in Romiton, Peshku and Karakul districts at that time are still used today. Farmers also used oats and other salt-resistant crops to clear the soil of salts.

At that time, three-crop crop rotation was the most common farming system. According to this system, the fields were divided into three parts. Two of them were planted and one part was allocated to black plowing. In this way the ground is rested. In addition, it was known in those days that soil quality improved when useful crops were planted.

Irrigated saline soils in Uzbekistan occur in different horizontal zones: southern (Surkhandarya, Kashkadarya, Bukhara regions), central (many districts of the Fergana Valley, Mirzachul, Jizzakh, some districts of Samarkand region) and northern (Khorezm, Republic of Karakalpakstan). These lands are composed of saline and saline soils. In addition, in the soil absorption complex there are soils with high content of sodium or magnesium, with very poor agrophysical properties (Bukhara, Kashkadarya regions, the Republic of Karakalpakstan).

In many districts and regions of Uzbekistan, the amount of sulfate in the soil is often much higher than that of chlorides, and natural salinity is chloride-sulfate or sulfate. In the districts of Bukhara region and the Fergana Valley, the composition of salts is mainly sulfates, and chlorides are found in very small amounts, so the type of soil salinity here is sulfate. In some other districts, sulfate-chloride and, in rare cases, chloride salinity types are found. In some parts of irrigated soils, a specific type of magnesium carbonate salinity has been identified in areas close to the surface of hydro carbonate fresh groundwater, which are found in meadow-swamp soils in a number of districts of Samarkand, Fergana and Tashkent regions.

Due to the high mobility of water-soluble salts, the areas of irrigated saline soils are constantly changing. Depending on the conditions of natural and economic factors, they may increase or decrease in a relatively short period of time, and salinity levels may increase or decrease at the same time. Irrigated soils are divided into 4 main groups depending on the degree of salinity - unsalted, slightly saline, moderately saline, strongly saline and saline. The salinity level is mainly determined by the soil salinity mechanism.

In determining the reclamation measures for irrigation of irrigated saline soils, of course, must take into account the specific properties of this or that soil - the nature, degree of salinity and salt content. In addition, depending on the natural conditions of the area, climate, soil location and its slope, lithological structure, water-physical properties of soils and especially hydrogeological conditions, the depth and movement of groundwater, irrigated areas are divided into several hydrogeological zones: surface and ground, infiltration zone to the lower layers of water; groundwater infiltration zone (in the form of springs).

The first zone - high slopes with high slopes and high atmospheric precipitation (500–600 mm), where the annual atmosphere is abundant. In these areas, well-permeable, small layers of rock, gravel, sand are located close to the surface (1.5-2.0 m). Groundwater is fresh, located at depths of 10-30 m and below the surface, and is characterized by its extremely high velocity (around 100 meters per day). Due to the high permeability of soil layers and groundwater, and the high level of groundwater flow, salinization does not occur in these lands, all the lower hydrogeological zone is washed away, so the lands of the first zone are reclamation-friendly lands and prone to salinization and swamping.

The second hydrogeological zone (groundwater infiltration zone) - starting from the lower, lower boundaries, occupies a relatively small area of the slope between the lower third zone. The upper fine-grained layer of soil has a thick loam and heavy sandy mechanical composition. Groundwater encounters heavy-layered layers in its direction, and they settle under compressive conditions due to resistance. These waters can rise or leak close to the surface (0.5-2.0 m). Despite the slow flow of groundwater (around 10 meters per day), the level of freshness is maintained (salinity 0.2-0.4 g / l), so the soils are almost not saline, only swamping can occur near the wound.

In the lower parts of the zone, soil salinity can be observed along the wound side in soils due to the decrease in groundwater movement and increased mineralization (1.5-2.0 g / l and more). Salinization of irrigated soils due to insufficient use of reclamation measures or its complete absence can occur mainly in the third zone (dispersal) in the zone of evaporation of groundwater.

The area belonging to this region in the territory of Uzbekistan consists of the widths of large plains 0.0001-0.001 with a small slope. The climate of these lands is dry and hot, the annual evaporation (600-1200 mm) is several times higher than atmospheric precipitation (100-300 mm). Soils have an almost heavy mechanical composition and a relatively high water carrying capacity. Sand-gravel deposits are deep (10-30 m and more). Groundwater is saline (mineralized) and located close to the surface. Their underground natural flow is very slow (low) or completely non-flowing. Due to this set of natural conditions, large amounts of saline groundwater are used for evaporation. In this case, the water constantly evaporates, and the salts gradually accumulate and saline the soil. The drier the air and its movement, the stronger (higher) the water-carrying capacity of the soil, the closer the groundwater location is to the surface and the higher its mineralization, the stronger (faster) the soil salinization. In Uzbekistan, saline and saline soils occupy large areas in the Fergana Valley, Mirzachul, Bukhara region, Amudarya or lower parts.

Several factors affect the accumulation of salts in the soil and its layers. The main sources of salt formation are atmospheric precipitation, soil-groundwater, soil-forming parent rocks, and finally the slow movement of runoff, the addition of salts from the sea to land by wind, plants, irrigation water, and other sources of salt accumulation.

From an experimental point of view, salts that accumulate in the soil along with running water or groundwater are of particular importance. The distribution of salts in the soil with water depends largely on the following local natural conditions: topography and geological structure of the soil, permeable (filtration) properties of the soil.

The role of climate in the distribution and accumulation of salts in soil composition. The accumulation of salts in the soil is often typical of hot and dry climates, and is widespread in Central Asia, including Uzbekistan. This is due to the fact that in dry and hot countries the atmosphere is not moistened to the deeper layers of the soil due to the lack of precipitation, the groundwater is located close to the soil surface and there is an excessive amount of glare. The amount of glare comes in two different forms depending on climatic conditions. First, free surface water glow, second, soil surface glow. As can be seen from the table below, we see that evaporation increases as we move from north to south, and accordingly, the evaporation increases by a certain amount.

In desert and semi-desert zones, the accumulation of salts in these zones is faster and more abundant due to less precipitation from the atmosphere (mainly in spring and winter) and the inability to moisten the deeper layers of the soil, and excessive evaporation. In addition, if groundwater is not located deep above the ground, it also rises through soil capillaries, which has a significant impact on soil salinity.

One of the factors strongly influencing soil salinity in desert zones is wind. These zones are associated with the wind regime during the summer months, characterized by drying of the surface, evaporation of dust and salts, and soil erosion. In nature, the influence of wind is great in the geochemical cycle of elements, especially in the salinity of soils. Through the wind, the salts are brought from the seas with dust and fine particles, and when the wind subsides or it rains, they accumulate in certain places at the expense of the salt fund. According to Clark, 2 to 20 tons of sodium chloride is released into the atmosphere from the atmosphere every year. Most of these are in the coastal areas. An example is the Aral Sea. According to scientists, 170-800 kg / ha of salts are brought from the sea to the Aral Sea region by winds every year.

In conclusion, it can be said that the climatic conditions of the place play a big role in the accumulation and mixing of salts in the soil layers. Therefore, it is necessary to develop new lands, taking into account the climatic conditions of each place, to increase its productivity in terms of reclamation, as well as to prevent salinization of soils based on agricultural techniques.

Bukhara region has 109 thousand hectares of irrigated lands per year, 39 thousand hectares of medium and 6 thousand hectares of high salinity. was found to be strongly saline. These data show that over the past 28 years, the average salinity of soils has increased by 1.9 times and strong salinity by up to 4 times, complicating the ecological situation. In addition, there are 175.0 thousand hectares of Bukhara region with varying degrees of erosion. Due to the negative impact of soil salinization, the region does not grow more than 65,000 tons of cotton annually. From 5 to 7 cubic km of water is used every year to wash away the toxic salts of these saline soils. If we do not prevent the causes of unfavorable reclamation of soils on irrigated lands in the current and future periods, timely reclamation of toxic salts and pollutants, soil fertility will decrease, crop yields will gradually decrease as well.

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