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STUDYING THE CONDITION OF IRRIGATED LAND IN THE MIL-MUGHAN ECONOMIC REGION

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ИЗУЧЕНИЕ СОСТОЯНИЯ ОРОШАЕМЫХ ЗЕМЕЛЬ МИЛЬ-МУГАНСКОГО ЭКОНОМИЧЕСКОГО РАЙОНА

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Abstract. The article examines the current reclamation state of irrigated lands in the Mil-Mughan economic region. There are favorable conditions for irrigation and growing heat-loving crops. However, the development of irrigated agriculture here is limited by soil salinity, which is widespread in the study area over quite large areas. Thick layers of soil and groundwater are susceptible to salinization. Conventionally, the territory is suitable for irrigation in hydrogeological and reclamation terms.

Аннотация. В статье рассматривается современное мелиоративное состояние орошаемых земель Миль-Муганского экономического района. Здесь имеются благоприятные условия для орошения и выращивания теплолюбивых сельскохозяйственных культур. Однако развитие здесь орошаемого земледелия ограничивается засолением почв, которое распространено в изучаемом районе на достаточно значительных площадях. Засолению подвержены мощные толщи почвогрунтов и грунтовые воды. Условно территория, пригодна для орошения в гидрогеолого-мелиоративном отношении.

Keywords: irrigated land, groundwater, Solonetz, Solonchaks.

Ключевые слова: орошаемые земли, грунтовые воды, солонцы, солончаки.

Artificial irrigation of fields is the most ancient and complex type of soil reclamation and surface climate. Currently, about 220 million hectares of land are irrigated in the world. The main irrigated crops are wheat, oilseeds, sugarcane, fruits, vegetables, etc. In warm climates, artificial irrigation allows for two or three successive harvests of wheat and other crops per year. In the Mil-Mughan economic region, about 201,413 hectares of land are currently irrigated. The main irrigated crops are cotton, wheat, etc. [1].

The Mil-Mugan economic region occupies an important place in the economy of Azerbaijan. This is a rather interesting object in natural and reclamation terms, located in the Kur depression, the formation of which has a close connection with the geological history of the Caspian Sea, in particular, fluctuations in its level from the end of the Tertiary time to the present day [2, 3].

Currently, as a result of global changes in the ecological state of the Earth's surface and the comprehensive deterioration of environmental factors, the real threat of environmental disasters is

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becoming particularly relevant. In this regard, in order to maintain the ecological state and balance of the region protect the biosphere from unfavorable environmental factors, there is a need to carry out large-scale work to assess the soil cover [4, 5].

Methodology and object of study

The object of the study is irrigated gray-meadow, gray-brown, saline and other soils of the Mil-Mughan economic region. The Republic of Azerbaijan belongs to areas of both rain-fed and irrigated agriculture. Lands suitable for irrigation due to soil and relief conditions occupy an area of about 3 million hectares, 2 million hectares of which are in the Kur-Araz lowland. On the right bank of the Kur River there are 4 massifs: Garabagh Plain — 325 thousand hectares (14.9%) — between the mountains of Gedak, Bozdagh and the Gargarchay River; Mil plain — 369 thousand hectares (17%) — between Gargarchay and Araz; Mughan Plain — 478 thousand hectares (22%), located in the bend formed by the Araz, Kur and its branch Akkusha; Salyan Plain — 144 thousand hectares (6.6%), located between the mouth of the Kur, its Akkusha branch and the Caspian Sea. The Mughan plain is conventionally divided into 3 parts: Northern (153.4 thousand hectares) — mainly north of the main channel of the Araz, middle or central (124.7 thousand hectares) and southern Mughan (200.2 thousand hectares). All land masses of the Kur-Araz lowland are favorable for irrigation and cultivation of heat-loving crops, including cotton [6, 7].

Results and discussions

The most important factor limiting the development of irrigated agriculture in Azerbaijan is soil salinization, which to one degree or another occurs in all irrigated regions of the republic, but mainly in the Kur-Araz lowland, where fairly large areas are covered by salinization in a thick layer of soil and groundwater. This is mainly due to natural factors, primarily the salinity of parent rocks with the widespread development of denudation in mountainous and foothill areas and accumulative processes in lowland areas, with an arid (arid) climate, the lack of natural drainage of the territory of lowland areas and, as a consequence, practical drainage of groundwater, its high mineralization (10-25-50 g/l or more), close location to the earth's surface (1-3-5 m) and places of recharge by underground pressure waters.

Economic factors that aggravate the reclamation situation include: unsatisfactory condition of the irrigation network, excessive length of earthen canals, unplanned irrigated fields, deviation from planned water use and rational agricultural practices, excessive water intake during the period of water availability and unproductive discharge, etc. All this ultimately leads to significant losses of irrigation water, recharge of groundwater and accelerated rise in its level. These waters are highly mineralized and in some places contain significant amounts of soda. Intense evaporation leads to an increase in salt accumulation in the upper horizons of soils, as well as to the development of soda-alkaline-salt-salt soils in certain places [8].

The main sources of groundwater supply in the Kur-Araz lowland are irrigation revenues in the form of losses due to filtration from canals and irrigation waters in irrigated fields, filtration and sub-channel waters of the Araz and Kur, their tributaries — mountain rivers running down from the slopes surrounding the lowlands, as well as atmospheric precipitation in foothill areas. About 8% of the area of the Kur-Araz lowland is occupied by forests, rivers, lakes, swamps, as well as lands that are inconvenient for irrigation due to relief conditions. The rest of the territory of the Kur-Araz lowland suitable for irrigation can be schematically divided into 3 characteristic areas in hydrogeological and reclamation terms.

The first region includes a zone of immersion and free flow of groundwater and occupies

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about 13% of the entire area of the lowland, covering mainly its periphery within the upper parts of the foothill sloping plains (proluvial-alluvial and proluvial-deluvial soils), as well as part of the Araz strip. The deposits of these formations are composed predominantly of highly permeable sediments, with a wide distribution of pebble or sandy-gravel soils in the surface layer, which causes more or less free filtration of surface water and intensive flow of groundwater into the underlying horizons along the slope of the terrain [9, 10].

The area is characterized, as a rule, by non-saline soils (gray-brown), significant surface slopes, and the stable occurrence of almost fresh groundwater at a depth of more than 5-10-20 m from the day surface. The salt composition of groundwater is hydrocarbonate or hydrocarbonate-sulfate, with mineralization of the solid residue less than 1-2 g/l. In the flow part of the water-salt balance of the first region, the natural flow of groundwater and the removal of bedrock salts into deeply incised mountain river beds, ravines or lower adjacent territories are of predominant importance.

The reclamation and hydrogeological conditions of the region extend to the lands located above the Upper Shirvan and Upper Garabagh canals within the Garabagh plain, above the Azizbeyov canal, and also partially in the Araz region. These lands are most favorable for the development of rational irrigated agriculture against the background of sparse drainage, based on the reconstruction of the irrigation network, proper organization of water use and regulation of surface runoff. Similar conditions exist in other regions of Azerbaijan — in the Ganja-Gazakh zone (without the southeastern part of the Goranboy region), in the Shaki-Zagatala zone, in Upper Garabagh, part of the Nakhchivan Autonomous Republic, etc. [11].

However, taking into account the interconnection of groundwater in the irrigated area, it is necessary that the composition of reclamation work in the first region should include measures to ensure the regulation of the water-salt regime and improvement of the reclamation situation in its plume part and the underlying lands of the second region.

To do this, it is necessary to completely reduce irrigation inflows into groundwater and make maximum use of internal groundwater resources by implementing radical anti-seepage devices on earthen channels, eliminating multi-heads and idle parts of main canals, regulating the surface flow of artesian and spring waters, installing vertical pumping wells for the purpose of complete economic use of operational groundwater reserves, use of the most advanced irrigation techniques, closure of the irrigation system after the final irrigation period and other measures.

The second region — predominantly with impeded drainage and, in places, pinching out of groundwater occupies about 7% of the total area of the lowland and covers mainly the middle and sometimes lower parts of the Garabagh proluvial-alluvial plain and the middle parts of the proluvial-deluvial inclinations of the Mil and Mughan plains. It is characterized by a reclamation situation differentiated by area, less severe on the axial parts of alluvial fans of mountain rivers, on elevations of the relief, and more severe in interconal depressions. An increase in the clay content of rocks, a decrease in their water permeability, the concentration of an excess amount of sodium sulfate salts in the upper horizons of soils when groundwater occurs with a salinity of 5-10-15 g/l at a depth of 3-5 m from the surface of the earth are a characteristic feature of the reclamation situation in most parts of the world area of the district (Table).

In a smaller part of the area, mainly in the Garabagh Plain (the middle part of the alluvial fan of the Terterchay River), there are areas with a very high level of soda-type groundwater, with mineralization in the range of 0.5-2.0 g/l. The proximity of groundwater to the day surface (0.5-1.0 m in spring and 2-2.5 m in autumn), associated with the pinching out of groundwater in a submountain sloping plain, stimulates the processes of land flooding and alkalinization of soils. In

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this regard, meadow, meadow-bog and swamp soils with a relatively small content of dense residue, but saline predominantly with carbon dioxide salts, medium and strongly solonetzic, clayey mechanical composition, are common in the territory; in places there are soda solonetzes and solonchak-solonetzes. The consumption part of the water-salt balance is generally covered by total evaporation, and to a lesser extent by natural groundwater runoff.

Table

SALINIZATION OF IRRIGATED SOILS IN THE MIL-MUGHAN ECONOMIC REGION

Administrative regions	*Area of irrigated land, ha*	*The degree of salinization in the 0-1 m layer, ha/%*					*Drained area*	
		unsalted	*salted*	*including*			*total, ha/%*	*closed horizontal, ha*
				weak	medium	severe		
Beylagan	48292 23.98	27415	20877 19.16	10790 15.53	6735 28.54	3352 21,06	39726 82.26	37726
Imishli	43551 21.62	17915	25636 23.52	9650 13.89	5381 22.80	10605 66,61	26189 60.13	20502
Sabirabad	62041 30.80	32591	29450 27.02	22809 32.83	5262 22.30	1379 8,66	62041 100	1946
Saatli	47529 23.60	14504	33025 30.30	26222 37.77	6219 26.36	584 3,67	47529 100	-
Total by economic regions	201413	92425 45.89	108988 54.11	69471 63.74	23597 21.65	15920 14,61	175485	60174

To improve the health of land, it is necessary to use a differentiated system of reclamation measures, the most important of which is the elimination of waterlogged groundwater through the full use of operational reserves of groundwater for irrigation and water supply needs based on the rational construction and operation of artesian wells and kyagris; capture of springs and devices for pumping vertical wells; drainage devices, washing of saline lands based on improving water-physical properties and eliminating soil salinity; use of chemical reclamation; an irrigation regime that ensures regulation of the water-salt regime of soils against the background of deep drainage and improvement of the salt composition of groundwater; irrigation using improved methods of watering crops and radical impervious devices on all earthen irrigation canals; combination of high agricultural technology and operation of irrigation and drainage systems.

The third region is characterized by practically drainless groundwater. It occupies about 72% of the entire area of the Kur-Araz lowland and covers the plumes of alluvial fans of mountain rivers, the alluvial plain of the Kur and Araz and the coastal lowland. Includes the massifs located below the Upper Shirvan and Upper Garabagh canals, almost all the lands of the Mughan-Salyan zone and South-Eastern Shirvan. The consumption part of the water-salt balance in the absence of artificial drainage accounts exclusively for evaporation with the accumulation of easily soluble salts in the soils of the aeration zone and in groundwater, which, in turn, contributed to a fairly strong salinization of soils.

On the plumes of alluvial fans, the salt composition of soils is predominantly sodium-sulfate or sodium-magnesium-sulfate. Groundwater lies at depths of 3-5 m, in places 5-10 m from the surface of the earth (the eastern part of the Shirvan Plain, characterized by low river water flow and poorly developed irrigation). Within the alluvial plain of the Kur and Araz and the coastal lowland, groundwater lies at a depth of less than 3-5 m and has a mineralization of 25-50-100 g/l. The salt composition of soils and groundwater is predominantly sodium-chloride. The soils are dark and light meadow, loamy-clayey and clayey, highly saline and very highly saline with a large number of

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salt marshes, occupying 374 thousand hectares (about 17% of the lowland area). Filtration capacity of the aquifer: within the Shirvan, Mil and Garabagh plains, Southern Mughan, the southern part of the Salyan steppe and in the Kur strip of the Mughan steppe, the filtration coefficient increases to 5-7 m/day, and in the central part of Northern Mughan and Central Mughan — up to 10-20 m/day or more.

In general, this area is characterized by the most difficult reclamation situation and requires a radical change in the water-salt balance, which requires: completion of work on organized diversion to the river. Kur flood waters of mountain rivers in order to eliminate existing swamps and prevent them in the future; complete elimination of groundwater drainage by installing deep drainage, leaching of saline lands against the background of this drainage, followed by a regime of irrigation of agricultural crops, excluding restoration of salinity, manifestations of solonetzation and ensuring further regulation of the salt regime of leached soils; reconstruction of existing irrigation systems, introduction of correct crop rotations, use of radical anti-filtration devices and improved methods of watering crops on irrigation canals; continuous intensive use of leached lands in combination with high agricultural technology and proper operation of irrigation and collector-drainage systems.

The conducted studies showed that in order to improve the reclamation state of irrigated gray-meadow soils of the Kur-Araz lowland, it is necessary to completely reduce irrigation inputs into groundwater and make maximum use of internal groundwater resources by implementing radical impervious devices on earthen canals, regulating the surface flow of artesian and spring waters, installation of vertical pumping wells for the purpose of full economic use of operational groundwater reserves, use of the most advanced irrigation technology, introduction of correct crop rotations and other measures.

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