



DEVELOPMENT OF THE OPTIMAL REGIME OF IRRIGATED LAND OF THE REPUBLIC OF KARAKALPAKSTAN

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Annotation: Based on the analysis of indicators of water consumption and the reclamation state of irrigated lands of the Republic of Karakalpakstan for a number of years, it is shown that water resources are irrationally used in the region. Long-term reclamation trouble is expressed in almost year-round, high standing of groundwater and salinization of soils. As a means of combating seasonal salinity, leaching is ineffective under these conditions, due to the small capacity of the aeration zone and insufficient drainage of irrigated lands. Wastewater disposal by collectors - the largest in the republic, indicates large transit discharges of water: from canals directly to collectors.

Keywords: improving discipline in the use of water resources, reducing unproductive water losses through reasonable consumption, streamlining the distribution of water at all levels of irrigation systems, repairing canals and cleaning collectors.

РАЗРАБОТКА ОПТИМАЛЬНОГО РЕЖИМА ОРОШАЕМЫХ ЗЕМЕЛЬ РЕСПУБЛИКИ КАРАКАЛПАКСТАН

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Аннотация: На основании анализа показателей водопотребления и мелиоративного состояния орошаемых земель Республики Каракалпакстан за ряд лет, показано, что в области нерационально используются водные ресурсы. Многолетнее мелиоративное неблагополучие выражается в практически круглогодичном, высоком стоянии грунтовых вод и засолении почв. В качестве средства борьбы с сезонным засолением, промывка малоэффективна в этих условиях, по причине небольшой ёмкости зоны аэрации и недостаточной дренированности орошаемых земель. Водоотведение по коллекторам - наибольшее по республике, указывает на



большие транзитные сбросы воды: из каналов прямо в коллекторы.

Ключевые слова: повышение дисциплины в использовании водных ресурсов, снижение непродуктивных потерь воды, путем обоснованного потребления, упорядочения в распределении воды на всех уровнях оросительных систем, ремонт каналов и очистка коллекторов.

When collectors are closed in spring (after cotton sowing, in order to obtain friendly seedlings), the effectiveness of leaching is reduced to zero, since artificially raised (temporarily) groundwater restores soil salinity. At the same time, the collectors are destroyed: the slopes swim, and the bottom is silted. The way out of this situation in the near future seems to be: improving discipline in the use of water resources, reducing unproductive water losses through reasonable consumption, streamlining the distribution of water at all levels of irrigation systems, repairing canals and cleaning collectors.

For a longer term, it is necessary to develop a strategy for the use of water and land resources in the Republic of Karakalpakstan, including a possible change in the structure of agricultural crops or a reorientation of agricultural activities, a change in the design of the hydro-reclamation system that allows rational use of water at all levels, up to the field, and others.

The geological and geomorphological structure in the lower reaches of the Amu Darya causes extremely difficult conditions for underground outflow of groundwater. The formation of the groundwater regime is characterized by the following features: directly under the influence of filtration from the river and large canals and therefore is closely related to fluctuations in water levels in them; on irrigated lands under the influence of irrigation and flushing, which have a pronounced seasonal character; the groundwater regime in the absence of underground inflow is characterized by a very small fluctuation amplitude.

Due to the weak natural drainage of the territory, caused by very small slopes of the surface (0.0001 - 0.0002), and the rather high moisture conductivity (in the horizontal direction) of highly permeable layers of sand and sandy loam, hydrostatic pressure is transferred in groundwater from rivers and canals, irrigated and washed fields (backwater and uplift of groundwater) to nearby areas.

In the absence of good drainage, there are difficulties in lowering and diverting groundwater, regulating the salt regime of soils. All of the above, aggravated by the poor technical condition of the conducting network of canals and drainage systems, violations of the irrigation regime and backward irrigation technique, leads to a relatively unfavorable ameliorative state of a significant part of the irrigated lands of the lower reaches of the Amudarya.

Against the background of natural conditions characterized by high hydrothermal climate indicators, low natural drainage of the area with very poor hydrogeological

characteristics, against the background of almost no sloping terrain, conditions were created conducive to the development of salt accumulation processes.

The whole history of the development of the irrigation of the lower reaches indicates that with an increase in the CFI, the difficulties of maintaining a water-salt regime favorable for the growth of agricultural crops increase. Under the current economic conditions, this regime is maintained by powerful leaching irrigation during the non-vegetation period, practically on the entire irrigated area, since any field that has not received such irrigation (leaching) will be, as it were, a zone of groundwater discharge from neighboring (washed) fields.

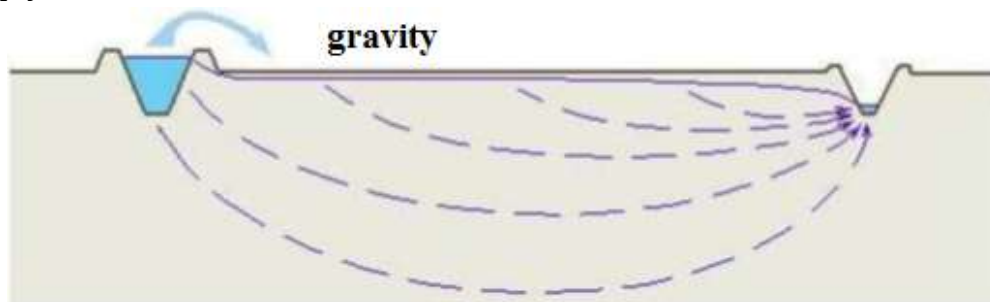
Once the irrigation systems of the Republic of Karakalpakstan existed on chigir irrigation, which was later replaced by machine water lifting. During this period, the supply systems simultaneously served as drainage systems, and the forced "rationing" of water supply excluded the possibility of overwatering. Those reclamation problems that exist now, then practically did not exist.

The current state of irrigation systems in the Republic of Karakalpakstan can be illustrated in Figure 1. Difficult drainage and backwaters on collectors lead to a situation where groundwater levels are high and, due to the high land use factor, their outflow is generally impossible. Their increased consumption for evaporation leads to severe soil salinization and inhibition of plants. Under these conditions, the regulation of the water-salt regime is extremely difficult [1].

a). Flow-through, source-drained



b). supply and exhaust



в). Supply-supported

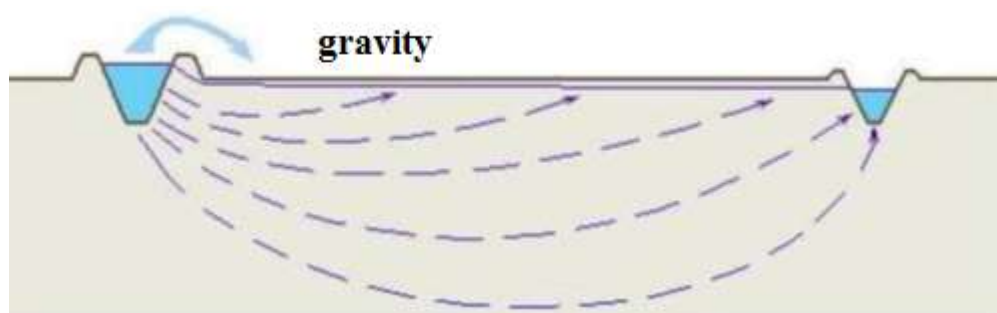


Fig. 1. Pathways of groundwater movement under various conditions of irrigation water supply and groundwater discharge (a - the case of buried channels and mechanical water rise, b - with gravity water supply and a functioning collector-drainage network, c - with gravity water supply and difficult outflow of drainage and wastewater).

Compared to other regions of Uzbekistan, the specific indicators of water intake and disposal in the Republic of Karakalpakstan are record high. The reason for this is the sowing of the moisture-loving rice crop, which in some years occupies up to 40 thousand hectares of irrigated area. The required irrigation rate of rice reaches 26 and more thousand m^3/ha . The water discharged from the rice fields is pumped from the collectors back to the fields by means of pumping. Thus, it is impossible to imagine a clear picture of the actual water supply and disposal.

По данным отчетности мелиоративной экспедиции достаточно высокие цифры: водоподача 17-21 тыс. $m^3/га$, а водоотведение 10-15 тыс. $m^3/га$. С учетом посевов риса, и биологической потребности растений безвозвратное водопотребление явно занижено, что позволяет предположить низкую эффективность использования оросительной воды на полях, т.е. несоблюдение режимов орошения и равномерности поливов.

According to the reports of the reclamation expedition, the figures are quite high: water supply is 17-21 thousand m^3/ha , and water disposal is 10-15 thousand m^3/ha . Taking into account the rice crops and the biological needs of plants, the irretrievable water consumption is clearly underestimated, which suggests a low efficiency of irrigation water use in the fields, i.e. non-compliance with irrigation regimes and uniformity of irrigation.

As a result of a number of reasons: growing rice, backwatering of collectors, mass washing of lands in spring (with insufficient drainage, poor natural outflow of water from the territory and unsatisfactory condition of collectors, groundwater in the Republic of Karakalpakstan is close to the surface almost all year round [2].

Close groundwater is very "beneficial" for growing rice, but completely unacceptable for growing cotton. The proximity of groundwater radically changes the irrigation regime of cotton, and although the soil characteristics of the Republic of Karakalpakstan require a large amount of irrigation, this is not observed in practice: farmers have been using subirrigation for many years, the use of groundwater to cover the water needs of cotton plants.



Surprisingly, large volumes of average annual drainage have almost no effect on the position of groundwater, which may indirectly indicate their backwater created artificially. Studies have found that: the closer to the soil surface groundwater, the greater their participation in the water consumption of plants, the less the need for agricultural crops in irrigation water, which helps to reduce the number of vegetation irrigations and related inter-row tillage.

But, with such irrigation, there are also such negative phenomena as: slope erosion and silting of collectors after the backwater is removed, as a result of intensive runoff of groundwater wedging out into the collector during intensive drawdown of their level. This is the reason for the need for a large amount of work on their cleaning every year. In addition, due to the high standing of groundwater, there is an intensive accumulation of salts in the upper layers of the soil [3].

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