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## Rational use of collector-drainage water

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**Abstract.** The greatest importance in the Republic of Uzbekistan is given to water management. The problem of water resources lies in the irrational use of collector-drainage waters, which lead to a deterioration in the quality of river waters. Of the existing collector-drainage waters in Uzbekistan, water with a salinity of up to 2 g / l makes up 38%, with a salinity of up to 3 g / l makes up 23%, with a salinity of more than 3 g / l, sometimes reaching up to 10 g / l makes up 37% of the total volume of collector-drainage water. With an increase in mineralization, the amount of toxic salts decreases, and these waters also contain a large number of pesticides and herbicides. Some of these waters are used for irrigation, the rest is dumped into depressions or rivers creating an environmentally unfavorable environment. Measures are necessary for the disposal and rational use of collector-drainage water, which will improve the environmental situation and may be an additional source of irrigation in a dry period. The object of research is collector-drainage water forming in the Ferghana region of the Republic of Uzbekistan. To solve this problem, it is necessary to improve the environmental situation and it is recommended that three points be implemented:

- study the existing volume of collector-drainage water and use it for irrigation;
- apply new technologies aimed at water saving during irrigation;
- do not discharge pumped water from vertical drainage wells with good mineralization into the drainage network.

Applying these technologies, it is possible not only to improve the condition of irrigation water but also to use water as an additional source of irrigation. By covering the deficit of irrigation water with drainage water and rational redistribution of the water limit from the source between the districts, the water supply in the regions is equalized and will reach 50-70 percent, and the water supply in the region will increase.

### 1. Introduction

In Uzbekistan, the last decade has faced the environmental problem of water resources. This is due in particular to global warming and the unsustainable use of water resources.

The purpose of our research is to identify sources of pollution and measures to eliminate them. Also identification of additional sources of irrigation that can cover the shortage of water resources in a dry year.

The object of the study is the collector-drainage water of the Ferghana region.

Consider the situation with collector-drainage waters in the Ferghana region, where a large number of them are formed. [4] In some cases, the salinity of the collector-drainage water is more than 10 g / l. [13] The use of these waters without accounting, and dumping highly-mineralized collector-drainage into freshwater bodies can lead to ecological disaster water resources. In this regard, it is necessary to study and adopt coordination measures for the rational use of collector-drainage water [14].



## 2. Methods

Are statistical data processing, field, and laboratory studies, methods adopted in agricultural reclamation.

## 3. Results and Discussion

In Uzbekistan, approximately 26 km<sup>3</sup> of collector-drainage water is formed. Of the total volume of these waters, waters with a salinity of up to 2 g / l make up about 10.4 km<sup>3</sup>, with a salinity of up to 3 g / l about 6.4 km<sup>3</sup>, above 3 g / l about 9.6 km<sup>3</sup> per year. [10] Depending on the mineralization, the toxicity of salts in drainage waters also changes. In collector-drainage waters up to 2 g / l, up to 20 % of toxic salts are present, which contain salts of chlorine, sodium, and pollutants - phenols and oil products. [7] With an increase in salinity up to 16–20 g / l, toxic substances make up to 50 % of the total salt content of drainage waters. [8] Collector-drainage water is discharged into rivers, and subsequently, the quality of the river deteriorates. Mineralization is increasing.

It is necessary to take measures to reduce the discharge of these waters into the river and rational use of water resources.

The importance of rational use of water resources and reducing the discharge of polluted collector-drainage water into the river is played by the use of these waters for irrigation at the place of their formation in a certain territory using water-saving technologies. [14] The solution to this issue defines new technologies and activities for the regions under consideration.

To improve the environmental situation of the above problems, it is recommended to perform three points:

- • identify the volume of collector-drainage water and use it for irrigation;
- apply new water-saving technologies for irrigation;
- to prevent the discharge into the drainage network of the water pumped out of the wells of vertical drainage with good salinity. [9; 10]

The geography of the use of mineralized drainage water for irrigation covers countries such as the USA, Israel, India, Pakistan, Egypt, Algeria, China, Russia, Uzbekistan, and other countries of Central Asia.

Great experience in assessing the applicability of various natural waters for irrigation has been accumulated and summarized in the works of domestic and foreign researchers. [6]

Among them, the works of A.N. Kostyakova, V.A. Kovdy, A.M. Mozheyko, V.M. Legostaeva, T.K. Vorotnik, O.A. Alekina, N.G. Minashina, G.A. Ibragimova, I.K. Kisileva, N.M. Reshetkina and Kh.I. Yakubova, A.U. Usmanova, R.A. Muradova [11; 20], A.R. Ramazanov, E. Kurbanbaeva, Kh.I. Yakubova, [19] M.A. Yakubova, Sh. Mukhamedzhanova, I.F. Bepalova, E.I. Chembarisova, [16] V.A. Dukhovny [3], M.A. Kh.I. Yakubova, B.S. Serikbayev [12], A.Sherov [17] and others.

In the existing works, much attention is paid to the establishment of permissible margins of mineralization of used waters. When establishing the maximum permissible mineralization, some authors take the non-salinity of the soil as the basis, others take the influence of mineralized water on plant productivity, and some proceeds from the solonetz hazard.

Many researchers (V.E. Eremenko; M. Khamidov [15], N.N. Khojibaev et al., N.M. Reshetkina, Mukhamedzhanov, G.A. Ibragimov, F.M. Rakhimbaev, N.M. Reshetkina, Kh.I. Yakubov, R.K. Ikramov [5], A.U. Usmanov, A.R. Ramazanov, T.U. Bekmuratov [2], M.A. Yakubov, E.I. Chembarisov [16] , Sh.Sh. Mukhamedzhanov, I. Akhmedov [1]) believe that despite the large drawdowns of groundwater, a small amount is used for irrigation.

According to SANIIRI, on the farm “Pakhtaaral” of the Hungry Steppe, pumped water with a salinity of 5-6 g / l was used for leaching. In this case, the last washing irrigation was carried out with fresh water. According to G.A. Ibragimova, the use of collector-drainage water with a salinity of 5-6 g / l for irrigation is quite acceptable for the sufficient growth and development of cotton in the Ferghana region. V.M. Legostaev notes that in the Ferghana Valley, irrigation with water with a salinity of 1.0-1.5 g / l under the conditions of a secured drainage system stimulates cotton growth. In

the experimental plot, irrigated with water with a salinity of 4-6 g / l, a cotton crop of 22.7-48.2 c / ha was obtained. A.U. Usmanov in his studies using mineralized water for irrigation indicates the need to develop several fundamentally important issues:

- characterization of the technical condition and ways to improve the existing drainage network, as a technical tool that provides a favorable background for the use of saline water for irrigation and leaching;

- establishing criteria for the applicability of saline water for irrigation of crops and leaching of saline lands, taking into account the hydrogeological-soil-reclamation conditions of the areas where drainage water is used for irrigation;

- regional distribution of mineralized waters of various quality;

- the establishment of soil differences for the selection of areas for irrigation with mineralized waters and the appointment of appropriate irrigation norms for various saline irrigation water;

- forecasting the quality and quantity of drainage water for the future.

M.A. Yakubov conducted field research on the lands of Central Ferghana. He notes that water with a salinity of up to 3 g / l can be used for irrigation in dry years on the drained tracts of Central Ferghana while maintaining crop yields.

When using saline water for irrigation in the conditions of newly developed and salinized lands of Central Ferghana drained by horizontal drainage, it is advisable to regulate the water level during the growing season within 1.5-1.7 m and in the non-growing period 2.0-2.5 m.

To ensure irreversible desalinization of soils and desalination of soil solution and groundwater M.A. Yakubov points to the need for irrigation regime in annual terms.

Sh.Sh. Mukhamedzhanov proposes to transfer the vegetation irrigation in the area of groundwater pinching out to the full provision of vertical drainage with pumped water. Most of the collector-drainage water is groundwater from vertical drainage wells. In the Ferghana Valley, water pumped by vertical drainage wells has a salinity of 1.0–1.5 g / l.

M. Yusupov also obtained a positive result when using saline water in western Ferghana. The experience of using mineralized drainage water in various countries of the world is summarized in the works of V.A. Dukhovny, Kh.I. Yakubov, A.U. Usmanov, M.A. Yakubov and others

V.A. Rafikov conducted experiments using drainage water with a salinity of 2 to 4.7 g / l in the Rometansky district of the Bukhara region using electropulse exposure. Irrigation with such water for three years without desalinization measures allowed to obtain a cotton crop of 20 to 27 kg/ha. After three years, he recommends flushing the fields from salinization.

In general, the data of the review show that the permissible values for water irrigation proposed by different scientists for irrigation vary widely from 2 to 7.0 g / l, and for leaching up to 12-16 g / l.

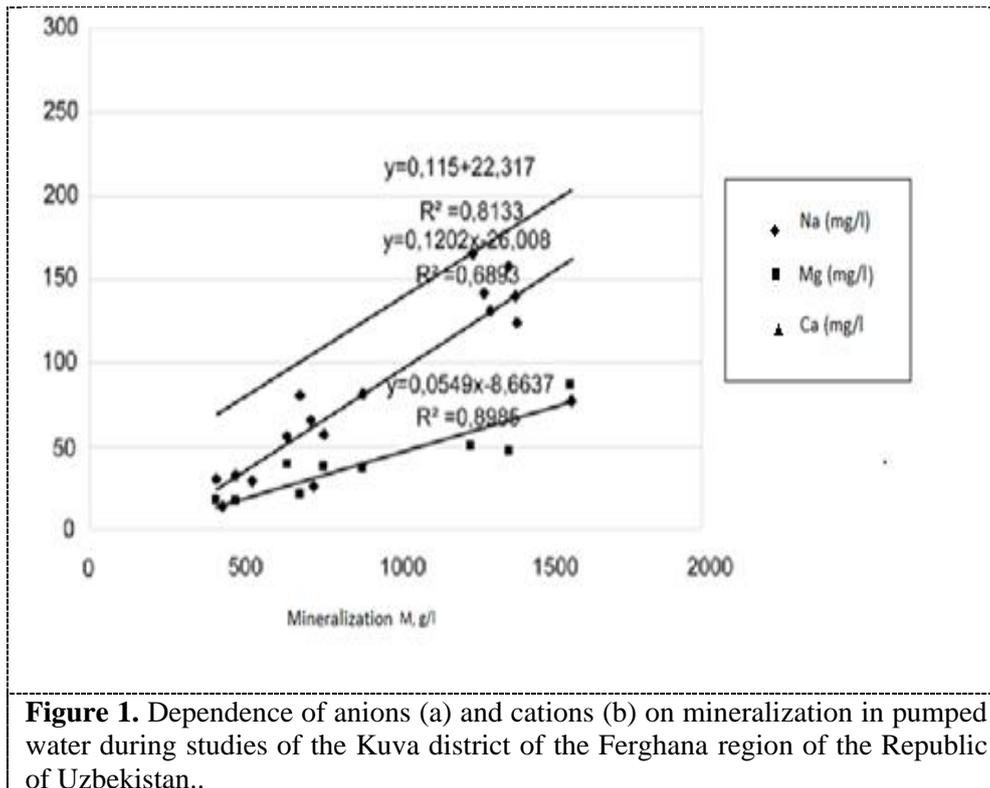
Thus, the opinion of experts on the permissible limits of salinity of the water used often diverges. Obviously, there can be no consensus on this issue, because Studies were carried out in various soil-climatic, hydrogeological-reclamation, hydrological-water management conditions, as well as for various crops.

Despite this, a generalization of the available materials indicates the possibility of using collector-drainage water for irrigation and leaching of soils. But for this, it is necessary to carefully evaluate the quality of these waters according to existing classifications and methods.

As mentioned above, it is recommended that the pumped water from vertical drainage wells with good salinity not be discharged into the drainage network. For this, vertical drainage wells were considered in the Ferghana region of the Republic of Uzbekistan.

In the Ferghana region of the Republic of Uzbekistan, 1264 vertical drainage wells are operated, and the salinity of the underground irrigation and groundwater pumped by them is low, which makes it possible to use them for irrigation of agricultural crops. At present, it is large. It should be noted that the pumped water is an internal reserve of each farm; these waters could serve as an additional source of freshwater for irrigation during the growing season. The most promising are the farms of the Kuva, Rishtan and Altiaryk regions, the Ferghana region of the Republic of Uzbekistan where a sufficient number of vertical drainage wells are concentrated with an average flow rate of up to 40-50 l / s and

with groundwater salinity not exceeding 1-1.5 g / l. The results of chemical analyzes showed that the salinity of the pumped water from the vertical drainage wells varies from 1 (Kuvaso) to 1.99 g / l (Altyaryk district) in terms of solid residue and from 0.05 to 0.17 chlorine. The quality of these waters is satisfactory and You can recommend them for irrigation. In these areas, underground tributaries range from 5.3 to 10.6 thousand m<sup>3</sup>/ha, and drainage flows from 10.9 to 14.3 thousand m<sup>3</sup> / ha. When using weakly mineralized pumped water as an additional source of water and bringing water supply to 100%, it is possible to increase productivity to 26.5 c / ha. Profitability can reach 14.2%.



The method of mathematical modeling was used to calculate the composition of hypothetical salts in the pumped-out salts, the results of which revealed the dependence of the amount of non-toxic  $CaSO_4$ ,  $Ca(HCO_3)_2$  and the amount of toxic ( $MgSO_4$ ,  $Na_2SO_4$ ,  $NaCl$ ) salts on water salinity, Figure 1. They show that with an increase in water salinity above 1.6-1.8 g / l, an increase in the amount of toxic salts occurs, the ratio of which was almost equal when mineralization was 1.2 – 1.4 g/l.

#### 4. Conclusions

The Ferghana region, located in the upper reaches of the Syrdarya, also experienced a water shortage during the growing season of a dry year. Our calculations were carried out for 2015-2018. Water availability during the growing season of 2015 is from 50 to 88 percent in the districts.

To cover the deficit of irrigation water in 2015, 2728 million m<sup>3</sup> was used for irrigation of crops in the region, 2,654 collector-drainage waters were used in 2018, and these waters were used spontaneously, without taking into account the quality and ecological reclamation of irrigated lands. To reduce the harmful effects of the use of mineralized water, we have assessed the quality of the water pumped out by vertical drainage wells and collector-drainage water in places of possible irrigation withdrawal.

The results of chemical analyzes showed that the mineralization of the pumped water from vertical drainage wells varies from 1 to 2 g/l in terms of solid residue and from 0.05 to 0.17 chlorine.

To ensure uniform water availability and reduce crop damage in the region, based on calculations of the quantity and quality of mineralized water, soil conditions with a planned allocation to the categories of land drainage, based on the calculations, we recommended the redistribution of the water limit from the source between the districts within the established limit for the region. By covering the deficit of irrigation water with drainage water and rational redistribution of the water limit from the source between the districts, the water supply in the regions is equalized and will reach 50-70 percent, and the water supply in the region will increase.

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