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# FEATURES OF THE WATER BALANCE OF THE IRRIGATED TERRITORIES

***Abstract:*** *The article studied the features of the water balance of irrigated areas on the example of the Kashkadarya oasis. When compiling the equation for the water balance of an oasis, it is recommended to divide the territory into old-irrigated and new-irrigated lands. The water resources of the oasis, old and newly irrigated lands taken from the local and neighboring basins are calculated for both areas. The interannual fluctuations of irrigation water resources were quantified. At the end of the article are listed the indicators that must be taken into account when compiling the water balance of the irrigated lands of the oasis.*

***Keywords:*** *water resources, water use, irrigation area, water balance, irrigated areas, surface water runoff, volume of water transfer, land reclamation.*

In the conditions of irrigated agriculture, one of the features of rational nature management is the ability to properly use the water resources available in the region. Inept water use in irrigated areas can cause an increase in unfavorable processes, which, in turn, will lead to deterioration in the ameliorative state of lands and a decrease in their productivity. The solution of these problems indicates the need for a comprehensive study of the water balance of irrigated areas. In this paper, this issue is considered on the example of the Kashkadarya oasis.

More than 90 percent of the available water resources in our country are used to irrigate agricultural land. In this regard, the quantitative assessment of water consumption of rivers on irrigated lands is of great scientific and practical importance. It is more appropriate to consider this problem on the example of the Kashkadarya oasis.

Due to the southern geographical position, during the year, a huge amount of solar radiation enters the Kashkadarya oasis, high air temperatures are observed, summers are very long, and winters are short and not very cold. Of the total area of the territory, only 2.27 million hectares of land are used in agriculture, which have favorable geological, geomorphological and soil and climatic conditions for the development of irrigated agriculture. Today, 1.5 million hectares of these lands are yaylau. About 30% of the land used in agriculture, which is more than 670 thousand hectares, is allocated for agricultural land [6]. With the improvement of the water supply system and land reclamation, there is an opportunity to increase the area of irrigated agriculture to 1.3 - 1.5 million hectares.

Unfortunately, the total runoff of surface waters formed within the basin of the river. Kashkadarya is clearly insufficient and varies from 600 million $m^3$ to 1.9 billion $m^3$ per year, and taking into account temporary watercourses, it averages only 1.18 billion $m^3$ in terms of water content per year. The shortage of water resources in the oasis is covered by water intake from the Zerafshan River through the Eski Ankhar Canal and from the Amudarya River through the Karshi Main Canal (KMC).

Due to the favorable natural conditions listed above, in the basin of the river. Kashkadarya irrigated agriculture has existed since ancient times. Due to the lack of local water resources at the beginning, i.e. In the 1st - 4th century AD, the Eski Ankhar canal existed here, which made it possible to use the waters of the river. Zerafshan for irrigation of the land of the oasis.

At the beginning of the 50s of the last century, repair and restoration work was carried out on the Eski Ankhar canal, and its re-reconstruction was carried out in 1974. As a result, through this canal, 184 km long with a head discharge of 45 $m^3/s$, it became possible to annually transfer 240-300 million $m^3$ of Zerafshan water to the Kashkadarya oasis [1, 2, 5]. Subsequently, the annual volume of water transfer from this canal gradually increased and in the high-

water year 1998 reached 600 million $m^3$ (Fig.).

At the beginning of the 70s of the last century, intensive development of the Karshi steppe began with the sole purpose of increasing the production of raw cotton. In this regard, in 1973 the first stage of KMC was put into operation. In the initial period of operation in the head water intake, the canal had a capacity of 80-100 $m^3/s$. Beginning in the mid-1980s, the volume of water intake through the KMC canal stabilized.

**Table**

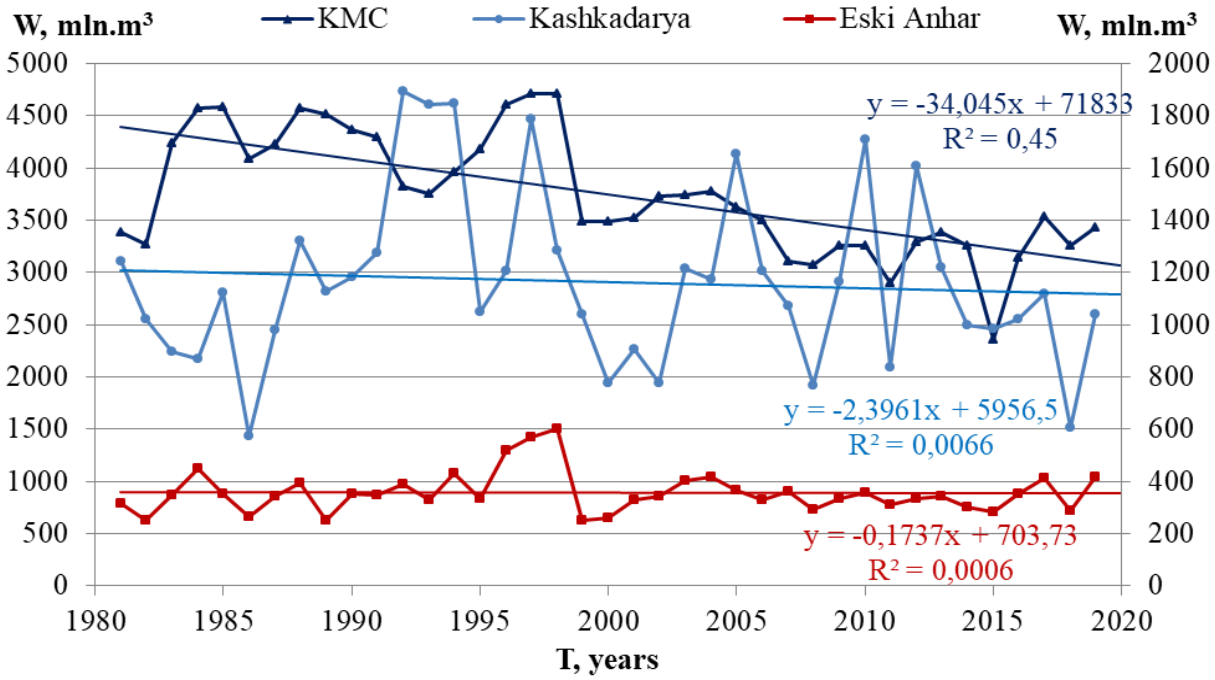
**Dynamics of water withdrawal to the Kashkadarya oasis for irrigation purposes**

| Years | Rivers, channels | | | Total |
|---|---|---|---|---|
| | Kashkadarya | Eski Anhar | KMC | |
| 1961–1965 | 18,6*/0,59** | 4,2/0,13 | – | 22,8/0,72 |
| 1966–1970 | 21,9/0,69 | 8,5/0,26 | – | 30,4/0,95 |
| 1971–1975 | 13,9/0,44 | 8,7/0,28 | 25,7/0,81 | 48,3/1,52 |
| 1976–1980 | 11,5/0,36 | 8,7/0,27 | 97,0/3,01 | 117,2/3,69 |
| 1981–1985 | 32,7/1,03 | 10,8/0,34 | 127,0/4,01 | 170,5/5,38 |
| 1986–1990 | 32,8/1,03 | 10,0/0,32 | 139,3/4,39 | 182,1/5,75 |
| 1991–1995 | 50,1/1,58 | 11,5/0,36 | 126,9/4,00 | 188,5/5,95 |
| 1996–2000 | 44,7/1,41 | 15,2/0,48 | 125,3/3,95 | 185,2/5,84 |
| 2001–2005 | 36,3/1,14 | 11,8/0,37 | 116,6/3,68 | 164,7/5,19 |
| 2006–2010 | 35,7/ 1,13 | 10,65/0,34 | 101,73/3,21 | 148,08/4,67 |
| 2011–2015 | 35,8/1,13 | 9,94/0,31 | 96,3/3,04 | 142,04/4,48 |
| 2016–2020 | 30,0/0,95 | 11,6/0,37 | 105,8/3,34 | 147,5/5,06 |

*Note: The volume of water withdrawal for irrigation purposes: *- in the numerator in $m^3/s$, **- in the denominator - $km^3$.*

As can be seen from the above table, the maximum amount of 1.58 $km^3$ of water for irrigation was received from Kashkadarya and its tributaries (local water resources) in 1991-1995. During this five-year period, the amount of water taken from Zeravshan to Stary Ankhor and the Amu Darya through the Karshi main canals somewhat decreased. Since this year, the amount of water imported into the region from abroad has begun to decrease.

The above table does not give a clear idea of the annual change in the amount of water brought into the oasis from abroad. Therefore, the annual course of the amount of water supplied for irrigation in the oasis was studied (Fig. 1).




Pic.1. Water withdrawal dynamics in the Kashkadarya oasis for irrigation purposes

According to F.E. Rubinova and other researchers [3, 4], in order to minimize the discrepancy in the calculations, the water balance should best be compiled by five years. Therefore, a preliminary analysis of the dynamics of water intake into the irrigated massifs of the oasis was also carried out by us for five-year periods (table). As can be seen from the table, if the water intake according to KMC in the first half of the 1970s, i.e. 1973-1975, on average amounted to 811 million $m^3$, then in the second half of the period it increased sharply, and on average already amounted to more than 3 billion $m^3$. As already mentioned, taking into account the use of water resources for irrigation, the territory of the Kashkadarya oasis can be divided into the Kashkadarya-old-irrigated and Karshi-newly irrigated regions.

The territory of the old irrigated region is located in the upper and middle

reaches of the Kashkadarya River. These lands have historically developed a high culture of irrigated agriculture. The lands of this region are irrigated mainly at the expense of local water resources, i.e. waters of the Kashkadarya and its tributaries, as well as the Zerafshan River. The newly irrigated area is located in the lower reaches of the Kashkadarya River and is irrigated in small quantities with its waters. The main source of irrigation for this area is the waters of the Amudarya River, which comes here through the KMK. The border of these two irrigation regions passes through the dividing line of the upper and lower pools of the Karshi hydroelectric complex. An insignificant amount of KMK water is supplied by pumps to the upstream of the hydroelectric complex [7].

Thus, the above circumstances make it possible to single out the following features of the water balance of the Kashkadarya oasis:

1. Local water resources are insufficient for normal irrigated agriculture, which requires additional water withdrawal from the neighboring basins - Zerafshan and Amudarya;

2. The volume of water intake, both from the Zerafshan River and from the Amudarya, depends on the water content of the year and, in this regard, has a changing character, which affects the quantitative indicators of the elements of the water balance of the territory;

3. Taking into account hydrological conditions, i.e. sources used for irrigation of water resources, as well as hydrogeological and reclamation conditions The Kashkadarya oasis is divided into an old irrigated and a newly irrigated territory, which is reflected in their water balance.

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