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RESEARCH ARTICLE

THE CURRENT STATE OF WATER USE IN THE IRRIGATED ZONE OF THE REPUBLIC OF KARAKALPAKSTAN AND WAYS TO IMPROVE IT

[1,*]Koshekov Rashid Majitovich, [2]Bazarbaev Baxadir Abatbaevich and [3]Bazarbaev Miyrbek Qoylibayuli

[1]DSc Doctor of Technical Science, Nukus branch of Tashkent State Agrarian University, Uzbekistan
[2]The 3rd Year Student, Nukus Branch of Tashkent State Agrarian University, Uzbekistan
[3]The 3rd Year Student, Nukus State Pedagogical Institute, Uzbekistan

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ABSTRACT

It should be borne in mind that the main water resources of the Aral Sea basin – the flow of the Syr Darya and Amu Darya rivers, according to the Memorandum, are distributed among the water consumers of the countries of Central Asia. Therefore, the withdrawal of water from these sources, the established limit from year to year is complicated. In the contour of irrigated agriculture, the volume of water consumption of agriculture is determined by natural and economic conditions, the technical condition of irrigation systems, the applied equipment and technology for irrigation of agricultural crops. The magnitude of water consumption also depends on the water supply of a particular soil – climate district, district. About 90% of available water resources are spent on irrigation of cultivated crops, for carrying out vegetative, moisture recharge and wash irrigation in the irrigated zone. The article considers the assessment of the current state of water use, the technical state of irrigation systems, as well as improving the management of water user associations in conditions of water scarcity.

INTRODUCTION

Currently, 22101.4 km of irrigation network of various levels are functioning in the contour of the existing irrigation in the Republic. Of these, 861.8 km are trunk pipelines and 2733.4 km are inter-farm canals operated by water management operating organizations, which are financed from the state budget. The total area suspended from them is 500.1 thousand ha (Koshekov, 1992). It was established that, due to a steady decrease in the water content of the Amu Darya river, the head discharge of large canals significantly decreased with a corresponding change in the hydraulic and hydrodynamic indicators of the live section of the Kizketken, Kegaili, Kuvanysh - Jarma canals and others, accompanied by intensive siltation of their channels along the entire length. Due to siltation of channels, the throughput of individual channels decreased by 30-35% compared with the design. The actual value $\frac{B}{h_{cp}}$ reached 28-51.8 with an optimum of 16-18. As a result of siltation of the channels, the bottom of all channels rose and the actual value $\frac{B}{h_{cp}}$ decreased by 1.2-2.5 times in comparison with the initial parameters.

Corresponding author:* **Koshekov Rashid Majitovich,
DSc Doctor of Technical Science, Nukus branch of Tashkent State Agrarian University, Uzbekistan.

Depth reduction is accompanied by lateral erosion. In many places, a significant part of the dams is eroded, and with a small rise in the water horizon an emergency situation is created. The Kuvanysh-Jarma, Kyzketken-Kegaili canals are in the best position, where 92% and 79.1% of their lengths are, respectively, in satisfactory technical condition. These indicators are rather low along the channels of Pakhtaarna-Naiman, Mangit-Nazarkhan and make up 53% and 57% of the surveyed channel length, respectively (Baymanov…2011).

LITERATURE REVIEW

Koshekov .R.M. evaluates the existing technical conditions of irrigation systems, offers on their street improvement. The first ones cite Koshekov .R.M. indicators of water use efficiency at various specific lengths of the on-farm irrigation network. And also in the work of Koshekov .R.M, the efficiency coefficient of the channel system is given and measures are taken to increase them. As a result of the consistent denationalization of state farms, the liquidation of collective farms, shirkat farms was the formation of new forms of organization of agricultural production, farms and dekhkan farms. Therefore, the main scientific work of Koshekov.R.M is intended for the rational use of water resources at the level of WUAs and farms. Here he noted the application of the hydrographic management principle in creating WUAs (Koshekov, 2010).

METHODS AND ANALYSIS

With the modern technical level and condition of irrigational systems, organization of water consumption there are large losses of water , especially for filtration, evaporation during the transportation of irrigatory water though the arterial and inter-farm canals from the point of intake to the points of water outlets of the water – consuming economy. In the Republic as a whole, the volume of unfruitful consumption of water in some years reached 3.7 billion/m3 or 46% of the total water intake (2006) (Koshekov, 2010). From the point of water intake, from the Amu Darya river and its transportation to the border of administrative districts, up to 9% is irretrievably lost, from the borders of the district to the border of farms - up to 16% and on the internal irrigation network-29%, from the planned delivery to the water consumer (Koshekov, 1995). Internal irrigators with a length of 18510 km are in the sphere of influence Of the Association of water consumers (WUA), which operation is funded from the budgets of farmers and other farms. Of these, only 19 km (irrigation systems Kuvanyshdzharma and Pakhtaarna-Nayman) have concrete facing, 102 km are made from reinforced concrete trays (irrigation systems Pakhtaarna-Nayman, Mangit-Nazarkhan, Kattagar-Bozatau). From the perspective of the zone of command of irrigation systems, the unit length of the internal network ranges from 24.1 PGS. m / ha up to 52 pogs. m / ha with an average of 37m / ha in the Republic. The results of the study and calculations indicate the increase in the volume of water losses in internal canals as their unit length increases (Orlova, 1985). This leads to increase of the head water intake for the system as a whole, the volume of operating costs and, accordingly, an increase in the cost of water supplied to farmers and other water users (table 1). The efficiency of the main canals is 0.90, inter-farm - 0.84, on-farm network - 0.71 and the average for the system - 0.54. A sufficiently high efficiency of the main and inter-farm canals, the vast majority of which have an earthen bed, is due to the presence of “lenses” from ground and infiltration waters, which during their operation are connected to the filtration stream from the canal beds. Due to the formation of the “backed-up filtration” mode, the volume of losses decreases sharply, which significantly affects their efficiency. A similar situation is observed along the route of the on-farm irrigation network, the efficiency of which on average for irrigation systems is 0.71. Nevertheless, almost 1/3 of the volume of water allocated to the water consumer is lost irrevocably and does not participate in the formation of an indicator characterizing water productivity (Lev, 1990).

To ensure the sectors of the national economy with the necessary volume of water, a water use plan is drawn up annually on the basis of existing standards. The main consumer is agriculture, which accounts for more than 90% of the water taken from the source. For the remaining sectors, they comprise: utilities - 4.4%, energy - 3.4%, industry - 0.9%, fisheries and others 0.11% each. Analysis of the materials of operating organizations showed that for the period 1997-2013. the volume of the allocated water limit in the Republic as a whole from 10387 million m3 decreased to 8840.5 million m3. Actual water withdrawal amounted to 93.0% and 83.0% of the established limit. Observations made in various parts of the irrigated zone revealed significant deficiencies in the organization and use of water during the non-growing and growing periods. For this and other reasons of the organizational and managerial character in industrial practice, there is an enumeration or shortage of the allocated limit amount during the year (Table 2) (National Water…, 1996). Due to the low efficiency of irrigation systems as a whole and especially the on-farm network, the lack of proper control over the actual water intake from the source (inter-farm canals) and water consumption, frequent water excesses over the established limit, violations made in the organization and conduct of irrigation (during the non-growing season), vegetation irrigation, the specific water consumption of irrigated agriculture in the republic is quite high (Legostaev, 1961). As a result of the consistent denationalization of state farms, the liquidation of collective farms and shirkat farms, a new form of organization of agricultural production was formed - farms and dekhkan farms. Currently, they produce more than 90% of crop and livestock production in the republic (Koshekov, 2012). The formation of farms as an independent structure for the organization and conduct of agricultural production with the relevant rights and obligations to the state necessitated a review of the existing order and conditions of water use, and repair and restoration of the irrigation and irrigation and drainage network.

The main objective of the Association of Water Consumers is the rational use of disposable water resources, increasing the productivity of irrigated lands, protecting the rights of water consumers and representing their interests in government bodies and organizations (National Water…, 1996). Water Consumer Associations created in the Republic of Karakalpakstan with a total serviced area of 362.0 thousand ha, unites 7985 members, of which 7852 are farms. As WUAs were created, the vast majority of on-farm infrastructures were transferred to the balance of associations. The legal basis for the relationship between water users, the WUA and the Irrigation Systems Authority is the contractual relationship and the timely submission of an application for water. Water resources management on the example of WUAs is carried out according to the following scheme (Fig. 1). An analysis of the activities of WUAs in general indicates their effectiveness in water management (Koshekov, 2016).

At the same time, their creation according to the administrative-territorial principle has drawbacks in the organization of water use. In most cases, the amount of the annually allocated limit is not brought to the attention of water consumers, there is no water use plan for non-growing and growing periods, water is unevenly distributed between farmers, dekhkans and other households, and the rights of water consumers located in the lower parts of the water supply canals are infringed. Due to the uncertainty in the sources of financing and material and technical supply, the procedure for carrying out repair, restoration and maintenance work is to some extent difficult (Baymanov, 2011). Within the framework of the FAO UN «The practice in sustainable agriculture in the drought-affected region Karakalpakstan" under the subsection "water and soil management" in the period of 2004-2007, studies were conducted to assess the activities of AVP established within the hydrographic principle. The territory of the AVP "Suushi" was chosen as a pilot plot according to the administrative-territorial principe of water resources management. It is established that the hydrographic principle of water resources management creates real prerequisites for the equal distribution of the allocated limit between water consumers. Thus, before the transition of AVP to the hydrographic principle of water separation in 10 farms located in the upper part of the channel "Shoh-Aryk", within the limit

Table 1. Indicator of water use efficiency at various specific lengths of the on-farm irrigation network

№ п/п	Indicators	Groups of irrigation systems by specific extent, linear m/ha			
		I	II	III	IV
		(до 25 м)	(25,1-35,0)	(35,1-50)	(over 50)
1	The number of irrigation systems in the group	1	3	1	1
2	Average specific length, m/ha	24,1	32,5	43,1	52
3	Irrigated area in the group, % of the total	10,2	55,6	14,4	19,8
4	Water loss per 1 ha, m^3	5551	7579	6797	7041
5	Operating costs, soum	364500	1804300	315800	1035100
6	Cost of water supplied, soum/1000 m^3	358	561	979	795

Table 2. The volume of monthly water withdrawals, in million.m^3

a) during the washing period

Years	*Indicators*	*October*	*November*	*December*	*January*	*February*	*March*	*Total water intake*
1997	*Limit*	101,56	361,84	383,62	64,59	193,12	773,27	1878,0
	Actual	32,58	251,4	564,71	240,55	194,37	594,18	1877,83
2015	*Limit*	82,9	272,2	259,2	-	267,8	622,0	1500
	Actual	133,0	271,65	287,42	292,61	252,94	281,07	1518,7

b) during the growing season

Years	Indicators	April	May	June	July	August	September	Total water intake
1997	Limit	257,34	1108,68	1364,27	1635,66	1339,98	444,06	6150,0
	Actual	164,26	1167,26	1256,72	1157,09	1142,57	670,15	5558,05
2015	Limit	422,1	827,7	1277	1964,6	1718,4	628,3	6835,2
	Actual	341,36	466,65	681,44	1586,85	1640,54	690,16	5406,99

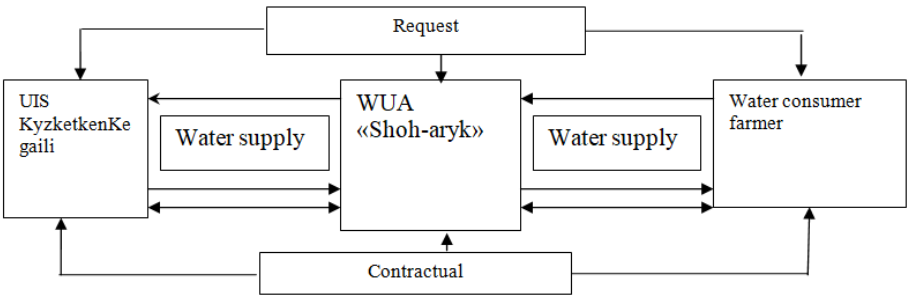

Fig. 1. Water management scheme for example «Shoh-aryk»

allocated to them, water availability was 97-100 %, and in 5 farms located in the lower part of the water source-74-80 % (Kosnazarov, 2003). After the transition to the hydrographic principle of allocation of the allocated limit and due to the regulation of the order of water supply according to pre-submitted applications from farms, the level of water supply has significantly improved and, regardless of the location of water consumers in relation to the source, amounted to 90-100 %. The recommendations, which were prepared by the author on the basis of the obtained data are widely used in industrial practice in the Republic of Karakalpakstan (Koshekov, 2016).

Conclusion

- In connection with the transition to limited water use, due to a steady decrease in the river water level, the discharge of large canals has significantly decreased with a corresponding change in the hydraulic elements of the canals accompanied by intensive siltation of their channels. At present, more than 30% of the existing trunk and inter-farm canals require repair and restoration work (reconstruction, mechanical cleaning and repair).
- Formation of farms as an independent organization structure with relevant rights and obligations necessitates the creation of WUAs to regulate water relations in farms.
- WUA infrastructure based on contractual relationships and the need for water supply, taking into account the composition and area of crops in farms, provides a sufficiently high level of water supply in its even distribution between users. When managing water resources according to the hydrographic principle, real prerequisites are created for the prompt and uniform distribution of the water limit without infringing on the rights of water users.

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