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Estimation of irrigation water use and its allocation at the districts' and farms' level in the period of agricultural sector's reorganization in the territories of three states in Fergana Valley.

Introduction

The most part of population of the Central-Asian region which is included five former soviet republics, at present these republics are the sovereign states, is involved in agriculture and the living well-being of these people depends on the production of grown crop.
The region locates in the arid zone with tough deficiency in fresh water and regular lack of natural moisture. In order to grow the cultivated plants normally the agriculture can be developed only on the base of irrigation in combination with proper agro technical methods which allow getting sustainable and high yields. However the water resources available are not enough to cover the irrigation needs and everything depends on the level of their use.
At present the water resources of region are estimated within the range of 111 cub.m3 per year along the basic Sirdarya and Amudarya River basins. The main part of up to 75% is used for irrigation (Table 1). When the irrigation area makes 8,5 million hectare then one hectare of irrigation area is supplied with 10,5 thousand m3/ha and the loss along the irrigation canals is disregarded.

Overall water intake along the Sirdarya and Amudarya River basins

Republic	Water intake for irrigation, cub.km
Uzbekistan	45,41
Kyrgyzstan	2,74
Tajikistan	13,28
Kazakhstan	6,43
Turkmenistan	21,14
Total	89,000

In soviet time while having a planned economy the states of the Central Asian region had uniform economic space, the unified power and irrigation systems, shared water resources, single agrarian-economic policy in region aimed at production of a certain crop. The water strategy of region, like planning of irrigation systems, location of irrigations systems with regard of cotton crop rotation, regulation of water resources mainly in the way of irrigation regime, water resources management was accordingly built on the base of unified regional scheme.
After the disintegration of the USSR each republic of the Central Asian region has got its administrative boundaries, political, economic and social conditions which are sharply different from each other. And all these, to some extent, have led to the change of former well-established approaches of coexistence. Together with them the management system of water resources and water use has changed within its scope on the quite lawful basis providing for interstate interests to each of them.
The changed political and economic mechanisms of states of the Central Asian region have brought to revision of the water strategies in region. At the given stage of transition to the market relations, restructuring of agrarian sector, reorientation of agriculture by kinds of cultivation crops, the water sector is being reformed. The water use associations are being established on the base of formed private farms and the structure of areas under crops is changed.
However it's absolutely clear that, having shared water resources, the development of region is impossible without the elaboration of the unified strategy and approach in the water resources management and use with regard of interests of each state.

In the existing situation the elaboration of the unified principles and approaches is of special importance when the water sector, aimed at improvement of water and irrigation management, is under reform.

In the territory of Central Asia a highly developed unified irrigation system linked to and interrelated with all states of Central Asia is concentrated. Today the irrigation water is managed within the administrative boundaries of the republic. Large irrigation systems cross the irrigated areas of different states. In this case the irrigation water management is not kept in one region. The irrigation water management is under the jurisdiction of five states, namely, Kazakhstan, Uzbekistan, Kyrgyzstan, Turkmenistan and Tajikistan. Each state being on the different level of reformation of water and agrarian sector is confronted to difficulties of both intersystem and interstate nature.

Water resources management in each republic, having their own peculiarities relating to, first of all, socio-political and economic conditions also leads to the non-coordinated actions between the states and to irrational water use in each state as well as to the water deficiency in the region as a whole.

At present the excessive volume of water is used for irrigation of crops in the region. The actual volume of used irrigation water exceeds twice the required one in some regions. At the same time the main losses are related not only the irrigation system, which is in unsatisfactory condition today, but the irrigation field due to the low level of irrigation management.

Republic	Weight average norm «net-field»	Specific actual water intake	Water usage coefficient
	thousand m3/ha	thousand m3/ha	
Kyrgyzstan	4,8	7,1	67,5
Tajikistan	7,3	15,1	48,1
Uzbekistan	4,0	6,4	62,5
Average	5,3	9,5	59,3

As a result an environment is seriously damaged. It is possible to learn the methods of water conservation, but, without any incentives in order to save the water, these measures will be unsustainable. The improvement of water productivity with simultaneous increase of crop yields and enhancement of irrigation efficiency is a sustainable decision under condition when the operation and reliability of irrigation systems are provided with.

The criteria of improvement of irrigation water productivity must be optimal yield got under the minimum volume of irrigation water use. When the water sector is reformed the main advantage for improvement of irrigation water productivity and water management must be the responsibility for water which will limit the use of excessive water and discipline each water user.

Since 1992 the Interstate Commission for Water Coordination (ICWC) has been established to solve the problems of regulation, management, rational use and protection of water resources and coordinate the activity between the states. By efforts of the National Information Centre of ICWC (one of the departments of ICWC) and under support of the World Bank and European Development Bank the principles and methods of long-term development of water economy, perfection of management and effective use of irrigation water are elaborated in the Central-Asian region. In order to achieve the rational water use, improve irrigation management and effective water apportioning the reforms in irrigation sector should be built on the principle of participation and interrelation of both water users and water suppliers. The testing of reforms on the pilot areas with further dissemination of results is of great importance.

The decision of these issues should provide the improvement of irrigation water productivity, introduction of planning system for water requirement according to the scheme of crops' location. It is necessary to define and make the required technical improvements in the allocation system of water, drainage and water recording, to establish the sustainable relations between different levels of management. The reforms in the agrarian and water sector should be aimed at improvement of conditions of irrigation water use and for the direct consumers, to supply the crops in the field with required water and reach the high water and land productivity. With scant water resources available

in the Central Asian region the irrigation water use is far from to be rational. Unproductive losses are traced along from the head water intake up to irrigation field. Irregularity of water allocation between consumers from the head of irrigation canal up to its end part reaches the figure of up to 30-40%.

In order to solve the issues of effective water resources management and use the National Information Centre of ICWC studies the irrigation of main crops in region for all five states of Central Asia. Since 2001 in the territory of Fergana Valley the National Information Centre of ICWC together with IWMI scrutinizes the issues of enhancement of water resources management and improvement of irrigation water and land productivity on the plot level.

In the article, materials of assessment and analysis of irrigation water distribution at rayon and collective farm levels and of water productivity before reorganization of the agrarian sector for three oblasts located in the Fergana Valley in three states of Uzbekistan, Tajikistan and Kyrgyzstan are given. The materials given in the article are the recent data regarding water use in the past management system at rayon water management administration level and regarding irrigation water use at collective farm level. The assessment results and the given materials would be useful for comparing them with the results of assessment of irrigation water management and use that were received after reorganization of the water and agrarian system in three states.

1. Natural-economic conditions of Fergana Valley

1.1 General features of Fergana Valley

Fergana Valley represents itself as an isolated region with complicated tectonics which had predetermined the diversification of relief forms. In the north Fergana Valley is framed by the Chatkal and Kuramin mountain ridges and in the south by Turkestan and Alay ones. In the east it is closed by the system of Fergana mountain ridges and in the west it has the narrow passage and exit to the Golodny (Hungry) steppe.

The basic water supply resource of Fergana Valley's rivers is snow-glacial supply which is collected in the cold season of the year. The maximum flow in the Fergana Valley's rivers is marked in March up to June and it decreases in December up to February.

In the territory of Fergana Valley seven regions of three states of Central Asia, like the Osh, Djalalabad and Batkent regions of the Republic of Kyrgyzstan; the Andijan, Namangan and Fergana regions of the Republic of Uzbekistan and the Sogd region of Tajikistan are located.

1.2 Natural-climatic conditions

The regions of Fergana Valley differ among themselves by the altitudinal belts identifying thereby the soil-meliorative conditions of territory (Table 3).

The climate of this zone is acutely continental one. For foothill areas the zone conformity to natural laws of changes of climatic conditions is defined. The general climatic features are high temperature and dry air, sharp fluctuation of daily and seasonal temperatures. The average temperature in January varies from - 2, 5° up to +2° and the average temperature of July is about 30°. The annual distribution of air temperature and rainfall depends on the area's height. With heightening of area the quantity of rainfall increases and the air temperature decreases. The rainfall is mainly in winter and in spring. Summer is droughty. From July up to September there is no any rainfall almost. The annual rainfall makes up from 100mm up to 200 mm for a flat zone and up to 450mm for the foothill areas.

1.3 Hydrography and irrigation network

The basic waterway of Fergana Valley is Sirdarya River which is formed by junction of Narin and Karadarya Rivers. Sirdarya River flows in the direction from north to south-west dividing Fergana Valley into two asymmetric parts of narrow right-bank and wide left-bank.

Sirdarya River intakes many inflows; the largest of them are from Isfara, Soh, Isfairam, Shakhimardan and Karadarya Rivers of the left bank and Narin, Namangansai and Kasansai Rivers of the right bank.

The basic source of irrigation valley is Narin, Karadarya Rivers and side inflows of Sirdarya River. The side inflows within the Fergana basin do not carry their water up to the riverbed and they are completely taken for irrigation. All rivers of valley have their hydrological regime inherent in waterways of snow-glacial supply. Large rivers and separate inflows are regulated by the water basins mainly in the irrigation regime. The most part of inflows is not regulated; however, thanks to the type of supply a flood is coincided with the time when grown crops consumed the water in this zone.

The irrigation system of Fergana Valley has developed according to the requirements of irrigated agriculture and land reclamation intended for irrigated agriculture. The main network and constructions were developed in the flat part of valley where the Namangan, Andijan, Fergana and Sogd regions are included to. Big canals, like Big Fergana, North Fergana, Big Andijan and South Fergana canals, supply the water of Narin and Karadarya Rivers to the valley's irrigation land of three republics as of Uzbekistan, Kyrgyzstan and Tajikistan. The main part of this irrigation network locates in the territory of Uzbekistan. The most part of irrigation land of Kyrgyzstan and Tajikistan is supplied by their internal irrigation systems, like Aravan-Akbura and Khodja-Bakirgan canals.

1.4 Structure of areas under crops

The structure of areas under crops differs from each other by the states located in Fergana Valley. In Uzbekistan and Tajikistan the most of part of the total area of irrigation land is under cotton and makes up 39% and 38% and 26% and 27% is under wheat accordingly. In Kyrgyzstan the situation is a little bit differ: 1% is under cotton in Batkent, 7% is in Osh and 17% is in Djalalabad regions and 33, 33 and 36% is under wheat accordingly. In Kyrgyzstan tobacco, corn and fruit crops are the most widespread crops which occupy the area after wheat.

2. Estimation of irrigation water use on the various levels by regions

2.1 Estimation of water supply and efficiency of irrigation water use

It is known that the reforms taken place in the water sector of agriculture should be aimed at improvement of conditions of irrigation water use both for the direct consumer, in this case for farmers, and for water supply of crops in a field. One of the main positions is to study the ways of improving the irrigation water use productivity. In order to solve this task a number of some issues should be considered. First of all, it should be taken into account that the irrigation land, when the deficiency of irrigation water in the Central Asian region takes place, is not always supplied with required volume of water to irrigate the crops. Therefore, the rational water apportioning at all levels of consumers of farms, districts and canal system is of special importance. All these levels of irrigation water management and use are interrelated and interdependent. The administration of canal system should have information on the volume required and regime of irrigation water use available along the length of all its canal command area. The district Water Use Service or Water Use Association can and must provide this administration with such information. In its turn, each district level should get such information from farms within its area. However the water apportioning will not be rational if we do not have any clearness in irrigation water use in respect of knowledge of areas under crops' structure, actual requirement of water for each crop, accurate schedule of irrigation of each crop. Therefore it is very important to study and have information on the required volume of irrigation water and regime of water use and on their basis to draw up the schedule of water supply and show it to the water supplier.

Within the framework of Integrated Water Resources Management in Fergana Valley Project we have analyzed the actual irrigation water use at the collective farms' and individual farms' level.

The issues on water supply of irrigation land and its productivity have been studied as well. Considering the complicacy of existing irrigation network and prevalence of mutually complementary of large irrigation systems in Fergana Valley, the canals' systems of the least dependent from the other canals and providing only the canal command irrigated lands have been chosen for analysis.
Irrigation water allocation by regions of each republic in Fergana Valley as well as in the region as a whole is made according to the given limit from region to district and from district to farm. The volume of limit from region to districts and from district to farms is defined by the plan of water use in respect of the required water intake estimated proceeding from the structure of areas under crops and irrigation norms for crops.

Planned or required water intake is a volume for each district and farm defined on the base of natural-climatic and hydro modulus zoning of the territory with regard of sow and composition of crops as well as technical condition of irrigation systems.

Limit. Being based on the water content of the year, the Ministry of Agriculture and Water Resources fixes limits for water users. Annually before vegetation and inter vegetation periods the regional departments, in their turn, make the plan of districts' and farms' water use proceeding from the average indexes of actual water intake for the last three years and on the base of limits received. They define a limit necessary for the specific farm for the current period and after that they distribute the limits to districts and the last ones, in their turn, share the limits from the angle of a farm.

Actual water intake. It's an actually received volume of water intake for irrigation**.**

2.1.1 Estimation of water supply available and specific water supply

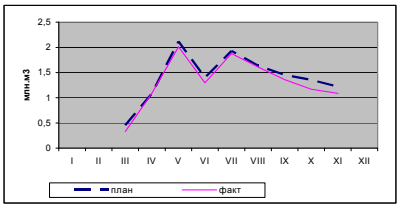
Irrigation water use by regions in Fergana Valley is not the same and depends on both the soil-climatic conditions, relief of land and from location relatively to a water source. The closer the territory locates to the zone of formation the more it is supplied with irrigation water as well as the higher the irrigation land locate along the canal the more it is supplied with. The performed analysis of actual materials, which were got from the regional and district water economic bodies, showed that on the base of given indicators the regions of the Republic of Kyrgyzstan are the most supplied ones among the regions of Fergana Valley. In the vegetation period of 2000 year the indicator of water supply makes 0, 87 in the Osh and Djalalabad regions up to 1,02 in the Batkent one. In the Republic of Uzbekistan the water supply available makes up the figures from 0, 65 in the Namangan region up to 0, 87 in the Fergana ones. In the Sogd region of Tajikistan the water supply indicator has made 0, 73. The specific water supply by regions differs within the wide range from 12, 3 thousand m3/ha in the Sogd region up to 10, 3 thousand m3/ha in the Batkent one. As for the rest regions the specific water intake has made the closely-connected value from 7, 0 thousand m3/ha in the Djalalabad and Namangan regions up 7, 5-8, 0 thousand m3/ha in the Osh, Fergana, and Andijan ones.

2.1.2 Irrigation water allocation by districts and farms

Republic of Kyrgyzstan
Water allocation is not regular both between districts and Water User Associations along the Akburin Canal in the Osh region. It is impossible to tell that the districts located in the head of canal are more supplied then the ones which locate in the lower part. As for collective farms irrespective of districts the WUAs located in the head of canal are more supplied with.
At the height of vegetation the actual water intake makes 45 mln. m3 to compare with required one of 30 mln. m3 in the Aravan district which locates in the head of canal, at the same time the Karasu district, located in the lower part of canal, does not receive 20 mln. m3 required. Among three WUAs, located in the Akburin canal's zone, the Akbura WUA, located in the head of canal, has the

actual water intake which is near to the required one. The actual water intake in the Janarik WUA, located in the middle part of canal, exceeds the required water intake twice. In the same period the Japalak WUA, located in the lower part of canal, receives twice less the actual water intake to compare with required ones. (Figure 1 -3).

Fig.1 Akbura WUA
(Aravan distric)



Fif.2 Janarik WUA
(Karasu district)

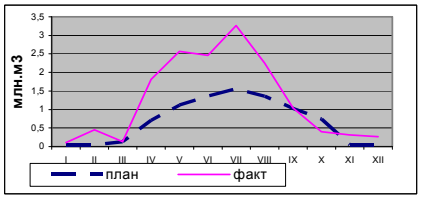
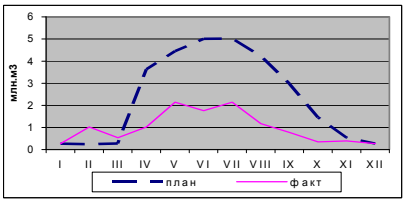


Fig.3 Japalak WUA
(Karasu district)



In the Batkent region the actual water supply is equal by value to compare with the required one both for region and for district and farms. During a year the water supply in the region, districts and farms is within the range of 1, 0.

In the Djalalabad region the non-regularity of water supply is noticed both between districts and between farms. Districts and farms, located in the head of canal, has more regular water supply then the districts and farms located in the lower and middle parts of canal. Besides, the irregular annual water allocation is noticed in the districts and farms located in the lower parts of canal. In the Bozor-Korgon district an actual and required water intake are almost the same during the year. In May the actual water intake volume made up 35 mln.m3 to compare with 20 mln.m3 of the required one, in June the actual water intake volume makes up 40 mln.m3 when the required one should be 30 mln.m3, since August the actual water intake is less then the required one and in September the required water intake for irrigation was supplied for 43% in the Nookent district (Fig. 4-6)

The type of within-year allocation of actual and required water intake at the farm level is the same like at the district level. The water allocation to farms is irregular and the water supply makes the indicators from 0, 87 in July up to 0, 14 in September for Taimonku farm and from 1, 27 in July up to 0, 5 in September for Aral-Sai farm.

Fig.4 Tekdik farm
Bosor-Korgon district
(head of canal)

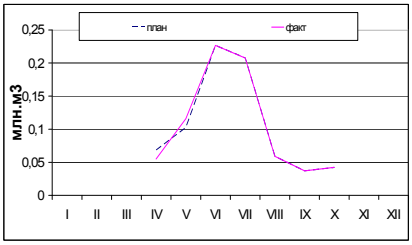


Fig.5 Toimonku farm
Bosor-Korgon district
(middle part of canal)

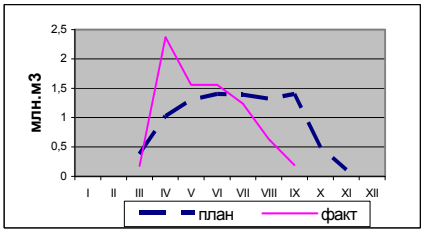
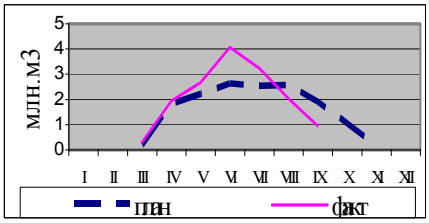


Fig.6 Aral-Sai farm
Nookent district
(end part of canal)



Uzbekistan

Irregularity of irrigation water supply (within the boundaries of selected districts) between the districts of Fergana region is not marked. A certain instability and irregularity of water allocation is typical for farms. The farms, located in the head of canal (in the Kuva and Tashlak districts), are supplied with irrigation water better then the farms (Niyazov farm) located at the end of South-Fergana Canal. In whole, within the South-Fergana Canal the irregular water allocation between

consumers exists only from the perspective of the year. The way of allocation of actual and required water intake and limit for region and districts, located in the South-Fergana Canal's zone, is close to the within-year allocation. Both in the region and districts the actual water intake in March – April is higher than the required one and limit. These months the above required and above limit water intake is used. From May to August the actual water intake is much lower than the required one and equal to the allotted limit by value, excluding the Kuva district, where the actual water intake is lower than limit from June up to September. In the height of vegetation irrigation the actual water intake is lower than the required one and limit at the farms' level (Fig. 7 – 9).

Fig.7 Navoi farm
Kuva district

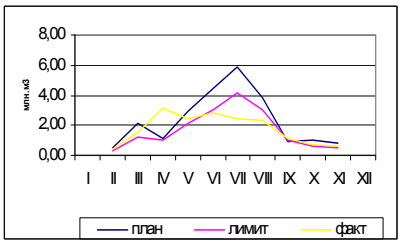


Fig.8 Navoi farm
Tashlak district

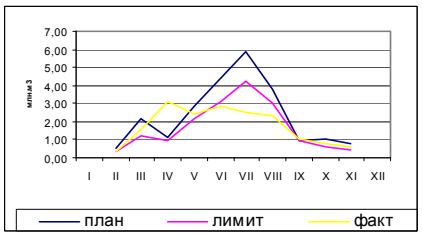
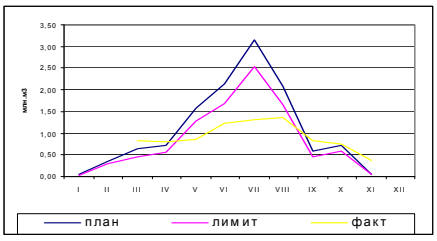


Fig.9 Niyazov farm
Akhunbabayev district



In the Namangan region the required water intake supply by districts and farms is irregular within a year and shortage of limit and actual water intake is a typical allocation for region, excluding November and December, when the actual water intake exceeds the required one and limit.
The Mingbulack district has more provided with drain of irrigation water in the vegetation period rather than the Papsky one, located much lower in relation to the canal. In July – August the Papsky district actually received 60 mln.m3 at a limit of 90-97 mln.m3, while the Mingbulack district got 61 mln.m3 at a limit of 62 mln.m3 (Fig. 10 -12).

Fig.10 Gigant farm
(Mingbulack district)

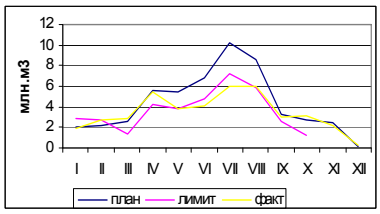


Fig.11 Navoi farm
(Mingbulack district)

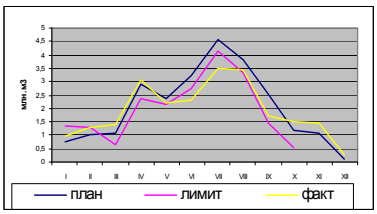
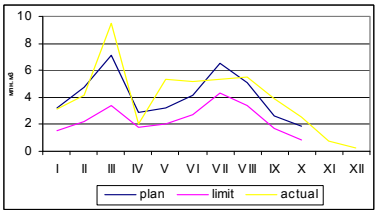


Fig.12 Pap farm
(Papsky district)



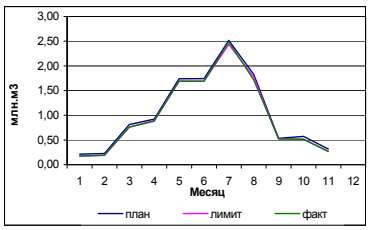
In the Andijan region the way of water intake allocation by region, districts and farms within the chosen Siza canal differs both between region and districts and between districts and farms. In the Izbaskent district in the height of vegetation irrigation the actual water intake is much lower than the allotted limit. The Balickchinsky district, though it locates lower along the Siza canal, has the equal annual allocation of the required water intake, limit and actuality. At the level of farm the difference of water allocation from the upper farm up to the lower one is expressive. Uzbekistan farm (Izbaskent district), which locates at the head of Siza canal, is completely supplied by the irrigation water throughout the year (Fig.13). The required and actual water intake and limit are equal by values. Siza farm and Uzbekistan farm (Izbaskent district), located in the middle and the end of the canal accordingly, have less provided with drain both per limit and per actual water intake (Fig.14; 15).

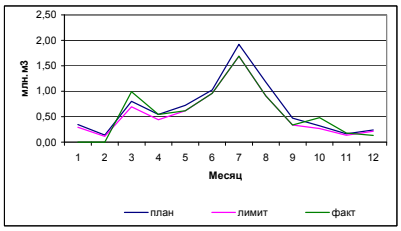
Fig.13 Uzbekistan farm
(Izbaskent district)

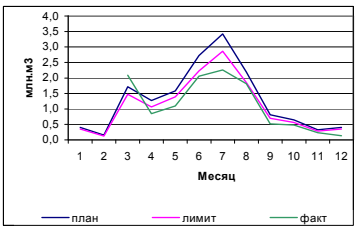
Fig.14 Siza farm
Balickchinsky district

Fig.15 Uzbekistan farm
Balickchinsky district

(head of Siza canal) (middle part of Siza canal) (end part of Siza canal)





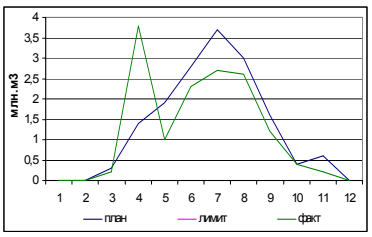


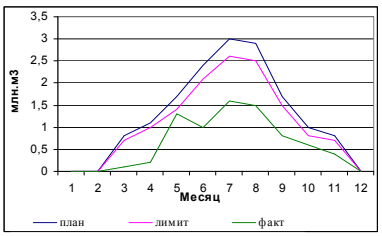
In the Sogd region the annual allocation of water intake is the same as per required value and allotted limit for region and districts. The annual allocation of actual water intake differs both between districts and between farms (Fig. 16, 17, 18).

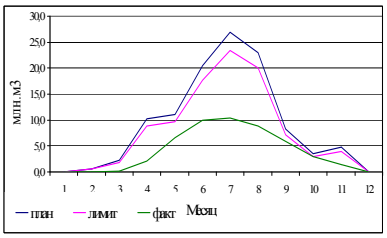
Fig.16 Bakhoriston farm
B. Gafurov district
(head of Siza canal)

Fig.17 Bobokhamdamov farm
Dj. Rasulov district
(middle part of Siza canal)

Fig.18 Samatov farm
Dj. Rasulov district
(end part of Siza canal)







In the Djabbor Rasulov district the water supply in the vegetation makes up 65% while in the Gafurov disctrict the supply is for 85%. At the farms' level the farms located in the head of Gulyakandoz canal is in the best position by the water supply. Bakhoriston farm (Fig. 16) is supplied for 87%, Bobokhamdamov farm is for 63% and Samatov farm is for 45% (Fig. 17;18).

2.2. Estimation of basic indicators of irrigation water use

As a result of analyzing the materials received from the regional executors we can come to conclusion that the irrigation water use is of various values as per basic indicators (water supply, specific water intake, irrigation water consumption for production, productivity of irrigation water) both between the regions and between farms. In some cases it is noticed that the water supply depends on the farms' location in relation to the canal and irrigation water use productivity in relation to the water supply. In the Osh region the farm located in the head of canal has the water supply indicator of 0, 94 while the water supply for region is 0,82, irrigation water consumption for yield is 1,7 thousand m3/ton and productivity is 0,6 ton/thousand m3. While in Japalak farm the water supply indicator is 0, 42, the consumption for yield has made up less value of 1, 3 thousand m3/ton and the most productivity of 0, 8 ton/thousand m3. In the Djalalabad region the excessive water supply of region, irrigation water consumption and productivity is close by values while the water supply is sufficiently high to the farms. Situation in the Batkent region is same like in the Djalalabad region. The specific water supply to the farms of Kyrgyzstan regions is changed within the wide range from 5, 9 thousand m3/ha (Japalak and Toimonku WUAs) up to 13, 97 thousand m3/ha (Janarik WUA) (Table 1).

In Uzbekistan the picture is a little bit differ. The more is water supply in the Andijan region the higher is the irrigation water use productivity. Uzbekistan farm of the Izbaskensky district has the productivity of 0,7 ton/thousand m3 for cotton and 2,2 ton/thousand m3 for grain crop when the water supply indicator is 0,95. While Uzbekistan farm of Balickchinsky district has the water productivity of 0, 4 ton/thousand m3 for cotton and 1, 2 ton/thousand m3 for grain crop at the water supply indicator of 0,74. It could be told the same about the farms of the Namangan region. In the

Fergana region the picture is vise versa, the farms which are supplied with less irrigation water volume have reached more productivity rather than the farms having sufficiently high water supply. Navoi farm of the Kuva district with the water supply indicator of 0,74 has reached the water productivity of 0, 4 ton/thousand m3 for cotton and 1, 3 ton/thousand m3 for grain crop, Niyazov farm of the Akhunbabayev district with the water supply indicator of 0,69 also has the irrigation water use productivity of 0, 5 ton/thousand m3 for cotton and 1, 3 ton/thousand m3 for grain crop, while Navoi farm of the Tashlack district has got the productivity of 0, 3 ton/thousand m3 for cotton and 0,9 ton/thousand m3 for grain crop when its water supply indicator is 0,97. The specific water intake in the farms of Uzbekistan makes up the figures within the range of 6, 9 up to 11, 4 thousand m3/ha. The irrigation water consumption for yield is much higher for cotton than for winter wheat and makes up 1, 4-6, 3 thousand m3/ton for cotton and 0, 5-1, 1 thousand m3/ton is for winter wheat in the farms of Uzbekistan.

The most consumption of irrigation water for agricultural production, both for cotton and winter wheat is noticed in the farms of the Namangan region and in Navoi farm of the Tashlack district of Fergana region.

In Tajikistan the most low productivity indicators of irrigation water use are in Fergana Valley. The value makes up from 0, 10 ton/thousand m3 up to 0, 14 ton/thousand m3 for cotton and from 0, 3 ton/thousand m3 up to 0, 9 ton/thousand m3 for winter wheat. And the highest consumption of irrigation water for agricultural production is from 7, 2 thousand m3/ton up to 10, 6 thousand m3/ton for cotton and 1,1 thousand m3/ton up to 2,0 thousand m3/ton for winter wheat.

Basic indicators of irrigation water use by regions and farms of Fergana Valley

Table 1

Region	Water supply	Specific water intake thousand m3/ha	Consumption of irrigation water thousand m3/ton		Water productivity, ton/thousand m3	
	%		cotton	grain crop	cotton	grain crop
Republic of Kyrgyzstan						
Osh	0,82	8,29	4,5	1,4	0,2	0,7
Djalalabad	0,81	6,92	6,7	3,0	0,1	0,3
Batkent	1,0	12,15	6,1	1,8		
Republic of Uzbekistan						
Andijan	0,79	10,28	3,2	0,8	0,3	1,2
Namangan	0,75	10,0	4,3	1,5	0,2	0,7
Fergana	0,88	10,4	3,2	1,4	0,3	0,7
Republic of Tajikistan						
Sogd	0,7	18,4	9,4	3,2	0,11	0,3

2.3 Reasons decreasing the irrigation water use productivity

Irrational water use and irrigation made with disregard of soil-meliorative conditions of irrigation field decrease the irrigation water use productivity in farms. In the farms, where the level of underground water is high, its recharge has made a negative impact on the productivity and with disre-

gard of this factor the farm has performed the excessive irrigation. The unavailability of washout regime of irrigation brought to the decrease of crop yield on the salty land. The improper selected irrigation regime and technology brought to the great losses in the field and deep infiltration on the land with high water permeability. The reason of decreasing the water use productivity was the complicacy of irrigation by furrows on the land located on the slopes which are underlined with pebbles.

2.4 Estimation of irrigation water use productivity by regions in Fergana Valley

The water use productivity was estimated as a ratio of a total crop to a total consumption of irrigation water. By regions the most productivity makes up from 0, 31-0, 32 ton/thousand m3 for cotton in the regions of Uzbekistan in Fergana Valley and 0, 71 ton/thousand m3 for winter wheat in Fergana Valley.
The least water use productivity is in Tajikistan both for cotton and winter wheat and makes up 0, 11 ton/thousand m3 for cotton and 0, 31 ton/thousand m3 for winter wheat. When the specific water supply made up 15 thousand m3/ha for cotton the 16 centner/ha of yield was got. In Kyrgyzstan in the Osh region the water use productivity is close to the values of water use productivity in Uzbekistan and makes up 0,23 ton/thousand m3 for cotton and 0, 7 ton/thousand m3 for winter wheat. The water use productivity for cotton and winter wheat is close and makes up 0, 15 ton/thousand m3 for cotton and 0, 33 ton/thousand m3 for winter wheat in the Sogd region of Tajikistan (Fig. 55- 60).

Fig.55 Irrigation water use productivity in the Fergana region

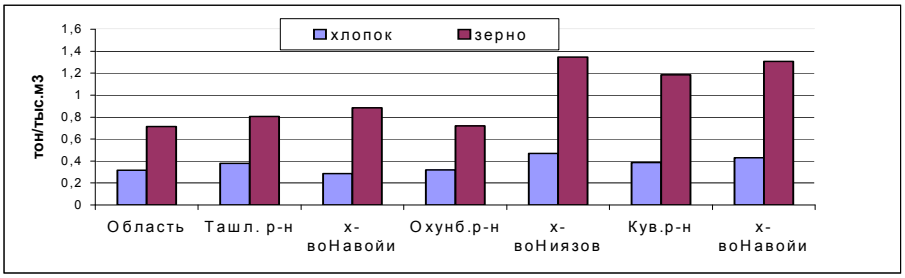


Fig.57 Irrigation water use productivity in the Osh region (Kyrgyzstan), ton/thousand m3

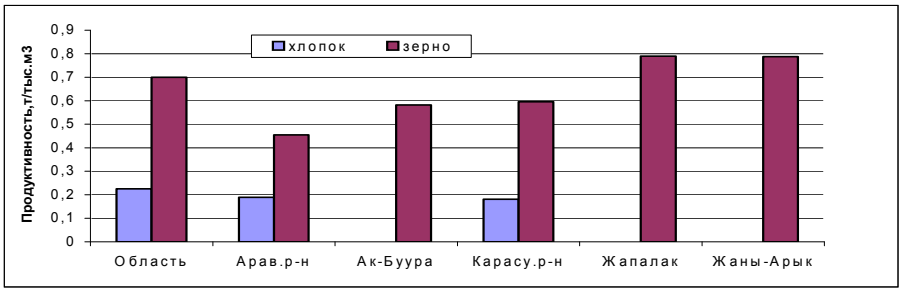
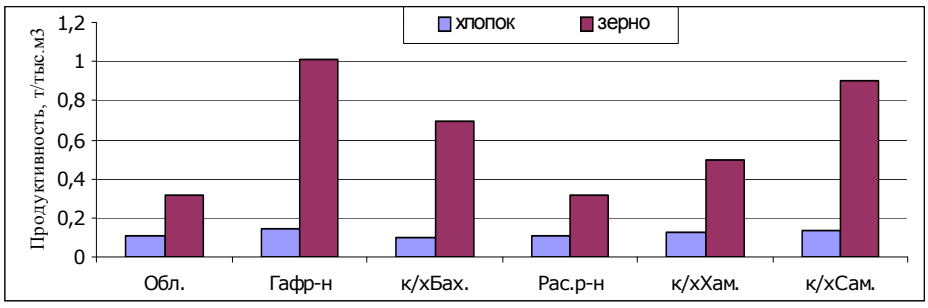


Fig.60 Irrigation water use productivity in the Sogd region (Tajikistan), ton/thousand m3



Conclusion

The results of analysis and estimation of situation made on the basis of materials of the three states' regions located in Fergana Valley and the experiences of both former and present projects in the region give the ground to conclude that in the region exist:

- water conservation reserves both at the regional and field levels;
- possibility to increase the efficiency of irrigation water use;
- possibility to increase the efficiency (factor) of region and field irrigation;
- possibility to increase the water use productivity up to the value which is closer to the potential one.

In order to solve these issues some work on estimation of conditions of water use and agricultural production available has been done with determination of parameters and their estimation, development of effective methods of irrigation water use and increase of water and land productivity as well.