GEF Project
WATER RESOURCES AND ENVIRONMENT MANAGEMENT

WARMAP-2 Consortium

DHV Consultants BV (the Netherlands)
Landell Mills Ltd (UK)
ICWS ((the Netherlands)

SUB-COMPONENT A2

PARTICIPATION IN WATER SAVINGS

REPORT

2000

REGIONAL MONITORING
of the 1-st stage of the competition

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LIST OF ABBREVIATIONS

RDWM	Rayon Department of Water Management
RDWAM	Rayon Department of Agriculture and Water Management
FLR	Fellowship with Limited Responsibilities
S/f	State farm
PC	Productive Cooperative
WUA	Water Users Association
APC	Agricultural Productive Cooperative
RSCE	Republican State Cooperative Enterprise
SCE	State Cooperative Enterprise
JSC	Joint Stock Company
AC	Agricultural Cooperative
SSGF	State Seed Growing Farm
K-z	Kolkhoz
S-z	Sovkhoz
PF	Peasant Farm
Pr.F	Private Farm
DF	Dekhkan Farm
DWMS	Department of Water Management Systems
WMA	Water Management Association
PROA	Productive Repair and Operation Association
OD ……. IN	Operational Department of …… Irrigation Network
MCDM	Main Canal Department Management
HAPROA	Hydro – Ameliorative Productive Repair and Operation Association

RESUME

167 objects (142 in 1992) of four categories were monitored:
- 29 (in 1999 – 25) rayon water managing organizations;
- 10 (in 1999– 12) water users associations,
- 57 (in 1999–47) kolkhozes /agricultural cooperatives/state farms
- 71 (in 1999. – 58) private farms,

and their proposals regarding water savings were recognized as original and were admitted by Oblast Expert Councils to the Phase II of the Competition.

Phase II of the Competition was carried out during the period of low water availability in 2000. Thus, external factors contributed to the competitors' ability to demonstrate practically, in such complicated situation, real ways for overcoming the water crisis.
Volume of water resources, used by water users has considerably decreased, along with reduction of ecological stability of river and water systems of the Aral Sea basin.
0.614 km^3 (planned – 3.0 km^3) were delivered to the Aral Sea basin by the Amu-Darya river basin, and 2.7 km^3 (planned – 2.8 km^3) – by the Syr-Darya river basin. It means, that in summer ecologic-epidemiological situation in the downstream of both basins remained strained, particularly for the Amu-Darya river basin.

At the background of the existing situation, water users had been supplied with water extremely irregularly, both as during the entire vegetative period as well as during the most tensed months (July – August).

Compared with 1999, irrigated areas within the responsibility zones of rayon water managing organizations – participants of Water Saving Competition, increased for 161.3 thousand ha, and had made in total 840.1 thousand ha. Such growth is related mainly to the increase of the number of the Competition participants, and the substitution of the organizations, drop-out from the Competition. However, in 2000, like in 1999, main agricultural crops of the oblasts were represented by::
- cotton – 33.8 % of irrigated area (in 1999 – 37.5 %);
- winter wheat – 17.9 % (in 1999 – 19.5 %);
- lucerne – 10.5 % (in 1999 –7.0 %);
- rice – 6.8 % (in 1999 – 3.3 %).

The highest shares: cotton – South Kazakstan oblast – 61.2 % ; winter wheat – Osh oblast – 31.3 %; lucerne - Kzylorda oblast – 30.3 % ; rice also in Kzylorda oblast – 41.3 %.

During the vegetative period of 2000 water intake limits calculated per 1 complex ha were in average 13.34 thousand m^3/ha (compared with 12.60 thousand m^3/ha in 1999), i.e. increased for 0.74 thousand m^3/ha. Growth of water intake limits happened mainly due to the growth of limits, calculated per complex ha for water managing organizations, participating in the Competition – 2000, from Osh, Sogdy, Khatlon and Kashkadarya oblasts.
The total reduction of actual water use per complex ha at the level of intakes for rayon water managing organizations in the oblasts, compared with the year of 1999, was not very significant, making 0.36 thousand m^3/ha (i.e. within the accuracy of water measurements). With that in three oblasts actual water use per complex ha had increased in 2000:
- Khatlon oblast: for 1.95 thousand m^3/ha (16.75 thousand m^3/ha in 2000 compared with 14.80 thousand m^3/ha in 1999);
- Sogdy oblast: for 1.08 thousand m^3/ha (15.11 thousand m^3/ha in 2000 compared with 14.03 thousand m^3/ha in 1999);
- Osh oblast: for 0.72 thousand m^3/ha (9.07 thousand m^3/ha in 2000 compared with 8.35 thousand m^3/ha in 1999).

The total reduction of volumes, actually taken from the sources compared with the limits, was 2.6 km^3 for the entire oblast (compared with 1.4 km^3 in 1999), or, if calculated per complex ha - 3.09 thousand m^3/ha (compared with 2.00 thousand m^3/ha in 1999 r.).

"Inputs" to the reduction of intake volumes were distributed by oblast – participants of the Competition (assessed at the level of water managing organizations – participants of the Competition) in the following way:

Kzylorda oblast	– 25 %
South Kazakhstan oblast	– 31 %
Djelalabad oblast	– 6 %
Osh oblast	– 6 %
Sogdy oblast	– 16 %
Khatlon oblast	– 5 %
Fergana oblast	– 0 %
Kashkadarya oblast	– 11 %

And with that, taking into consideration main conditions, facilitating such reduction, the four conditions could be selected (in order of their impact priority):

- Lack of physical ability to take the allocated water limits, due to lack of water in the sources or lack of necessary command levels in the sources.
- Exceeding of the allocated limits above real crop water requirements
- User's desire to reduce payments for irrigation water (Kazakhstan, Kyrgyzstan).
- Awareness of the necessity for water savings, particularly in the conditions of less water availability.

The following water managing organizations and water users carried out their activities in the conditions of "sharp" water deficit:

- In South Kazakhstan oblast, especially "sharp" water shortage was observed in the Dostyk canal area;
- Kashkadarya oblast;
- Kzylorda oblast

The following water managing organizations had demonstrated rational water use:

- Djalalabad oblast
- Fergana oblast

Water managing organizations of the oblasts, which had reserves for water savings, worsened their indices, to some extent, compared with the year of 1999:

- Khatlon oblast
- Osh oblast
- Sogdy oblast

While resuming the data on main crops yields, it is possible to mark that total shortage of water did not considerably impact on the yield level of the main crops in the objects of the Competition, except sharp decrease in winter wheat yield in Kzylorda oblast (downstream the Syr-Darya river basin) and some decrease of yields in Kashkadarya oblast (midstream the Amu-Darya river basin).
Considerable decrease of yields of cotton in Khatlon oblast (upstream the Amu-Darya river basin) resulted rather from land-reclamation conditions and insufficiently high level of agrotechnics, than from the water factor (the level of water availability here was one of the highest in the Amu-Darya river basin).
Thus, achievements of the majority of participants of the Competition were demonstrated in the form of sustainable results on the background of reduced (compared with the vegetative period of 1999) level of water availability.

Agro-economic assessment of the results of participants productive activities was maid mainly on the basis of the following major parameters: variable costs, gross output, gross benefit, return for inputs: land, cost of resources and irrigation water.

The total gross output in the participating farms in 2000 was in the amount of from 270 $/ha to 722 $/ha. The main share in the gross output belongs to cotton, winter wheat, rice, maize for grain, tobacco.

Average cost indices vary within the wide range: cotton from 100 $/rha to 800 $/ha, winter wheat from 10 $/ha to 450 $/ha, rice from100 $/ha to 300 $/ha.
Compared with 1999, costs of agricultural production in general decreased in Kazakhstan and Uzbekistan, and increased in Kyrgyzstan and Tadjikistan.

Gross benefit was from 50 $/ha to 550 $/ha. The trend of the benefit growth was detected in Kazakstan, in farms of the other republics the benefit had decreased.

The most profitable crops are:
- Cotton – gross benefit up to 1000 $/ha;
- Winter wheat – up to 450 $/ha (only for the Osh oblast, Kyrgyzstan);
- Maize for grain – 300-700 $/ha;
- Tobacco – up to 1000 $/ha;
- Potato – 800-1000 $/ha (for Osh and Djelalabad oblasts, Kyrgyzstan);
- Rice – 300-1500 $/ha (for Uzbekistan and Kazakhstan).

As a whole, for the region the average return for land (gross benefit $/ha) in 2000 increased for 33% in kolkhozes/cooperatives, and decreased for 10% in private farms. While comparing with the average indices of return for investments $/$, as a whole, the index decreases in kolkhozes/cooperatives for 17%.

Index of water productivity $/thousand m^3 had increased on 42% for kolkhozes/cooperatives and decreased on 4% for private farms. It is caused by growth of benefit along with water savings in kolkhozes/cooperatives, and water savings along with decrease of benefit in private farms.

Value of works, being carried out during the monitoring of the Competition, is, first of all, the revelation of positive and remained experience, which is initiated by water users themselves, without any interference from the “top”. Therefore, we are talking not about scientific experiments, which farmers and agricultural cooperatives are ready to carry out if they have incentives, but about methodologies, found by themselves in specific conditions of irrigated farming on their fields, as measures for rational use of water resources. It should be clearly understood, that activities, carried out by water users for water savings, are not experiments, dictated from the “top”, but a specific practice of irrigated farming in particular zones of the region. These activities could be extended, if initiatives would be duly assessed and stimulated. Such understanding is also important from the position of the evaluation of water savings sustainability, since it is obvious, that demonstrated practices of water savings were established before the Competition, and will exist after its completion. The Competition only promoted stimulation of further extension and public awareness of practical water savings methodologies. One of the important achievements of the Competition is gradual change of attitude to water as to an inexhaustible resource. The Competition stimulated the increase of water measuring level of on-farm irrigation networks in Fergana, Djalalabad, Osh and Sogdy oblasts.

As the experience of the A-2 Subcomponent shows, in the existing situation water users from the areas with low level of irrigation water availability and densely populated areas with traditionally high culture of farming are rather interested in rational water use and water savings. The incentives for their participation in rational use of water resources are, first of all, conditions of irrigated farming and existing traditions of solicitous attitude to land and water resources. In these zones growth of water use effectiveness could be carried out by the following scenario:
- at the first stage, minimal governmental support is required for maintaining and development of rational water use forms, which in accordance with the A-2 monitoring data, are initiated by water users themselves (interlacing of irrigated and “dry” row spaces, application of mulching covers, preventing excessive physical evaporation, application of “stage” irrigation by short furrows, application of concentrated irrigation and rotation of irrigation between sites, cultivation of drought-resistant crops etc.)

- at the second stage, (during the transition to chargeable water use) it is necessary to provide, on the basis of parity (government provides materials, equipment, carries out necessary metrological support, farms provide labor resources) water measurement of irrigation network at the level of farms and irrigated plots.
- at the third stage, (in the conditions of chargeable water use) the government proceeds, on the basis of parity (with partial reimbursement of water users costs), to a stage-by-stage integral reconstruction of irrigation systems.
- at the fourth stage, water users, who are interested in the reduction of irrigation network operation costs, commence the transition to more improved irrigation types and technologies, with governmental support (preferential loans, delivery of equipment by orders).

In the zones of newly developed lands it is necessary to carry out preliminary organizational and technical measures on training farmers for the principles of rational water use and saving.

INTRODUCTION

Objectives of regional monitoring of Subcomponent A - 2	
General	a) coordination and control of the methodology of work done by National Monitors with the aim to ensure reliability of assessment and analysis; b) identification of the best methods for water saving and rational water use, and description of the conditions under which specific oblasts methods can be applied elsewhere; to be considered while **developing a regional water strategy;** c) study and assessment of possibilities for the dissemination and application of positive results of pilot objects for water saving and rational water use in conditions of irrigated territories which are typical for the region; d) preparation of corresponding proposals and recommendations for the GEF Agency for the use in Components A-1 and B of the GEF Project.
Specific objectives of the reporting period	• Description of the initial situation preceding the second stage of the Water Saving Competition (as the basis for comparison) with the changes taking place during the process of the implementation of the water saving measures adopted by the competitors; • Understanding of the meaning and objectives of the proposals of the competitors on reduction of losses and rational use of irrigation water *(especially new initiatives of the competitors)* and the practicality of implementation; • Assessment of the correctness of understanding the objectives and tasks of the second stage of the Competition and the reliability of measurements carried out during the process of self-monitoring and monitoring by National Monitor, Oblast Managers and participants of the Competition; • Establishment of national databases comprising all the objects of the oblasts included in the Competition and planning of entering data and information about the objects into it; • Assessment and analysis of data collected in the vegetative period, which characterize the result of measures on water saving and rational water use; • Assessment of the achieved positive effects of rational water use sustainability; • Understanding of the organisational structure for water management and the incentives for water saving and rational water use; • Training of Oblast Managers in the principles of summarizing results of the Competition on water saving; • Preparation and submission of National Monitors reports on the assessment of the results of measures on water saving and rational water use of participants; submission of proposals and recommendations to National Coordinators, Regional Monitor, Oblast Expert Councils and the GEF Project Component A-2 Director.
Planned outputs	• Participation in the preparation and organisation of final seminar on

Objectives of regional monitoring of Subcomponent A - 2	
	the results of the first stage of Water Saving Competition; • Preparation of the booklet "Experience of the participation in water savings of the first stage of the Competition in the states of Central Asia"; • Report with the description of the results of the second stage of the Competition obtained by the main objects; • Recommended according the monitoring assessment distribution of prize positions among the participants of the second stage of the Competition; • Comments and proposals on the progress of work in the second stage of the Competition.

The work on monitoring of the Water Saving Competition started in July, 1, 1999 in the eight oblasts of the Aral Sea basin defined by National Coordinators of Central Asian countries as the competition participants was continued in 2000.

Participating Oblasts

	Republic of Kazakhstan	
South Kazakhstan	(Syrdarya river basin)	middle reaches
Kzyl-Orda	(Syrdarya river basin)	downstream
	Kyrgyz Republic	
Osh	(Syrdarya river basin)	upper reaches
Djalalabad	(Syrdarya river basin)	upper reaches
	Republic of Tadjikistan	
Sogdy (Leninabad)	Syrdarya river basin)	middle reaches
Khatlon	(Amudarya river basin)	upper reaches
	Republic of Uzbekistan	
Kashkadarya	(Amudarya river basin)	middle reaches
Ferghana	(Syrdarya river basin)	upper reaches

On the Amudarya river basin: 2 Oblasts (upstream – 1; midstream - 1).
On the Syrdarya river basin: 6 Oblasts (upstream - 3; midstream – 2; downstream - 1).

167 objects (in 1999 - 142) were monitored in four categories: 29 (in 1999 - 25) rayon water managing organisations, 10 (in 1999 - 12) water users associations, 57 (in 1999 - 47) collective farms/agricultural cooperatives/state farms and 71 (in 1999 - 58) private farms. Their proposals on water saving were considered by the Oblast Expert Councils as original ones and they were allowed to participate in the second stage of the Competition (**Table 1**).

Table 1 List of objects selected by Oblast Expert Councils for participation in the second stage of Water Saving Competition

Republic	Oblast, participant of the Competition	Years	TOTAL	including:			
				Vodkhoz	WUA	K-zes, state farms, cooperatives	Private farms
Kazakstan	**Kzylorda**	**1999**	**7**	**3**	**0**	**2**	**2**
	*	**2000**	**26**	**6 (3) *)**	**0**	**8 (6)**	**12 (12)**
	South Kazakstan	**1999**	**21**	**3**	**4**	**6**	**8**
	*	**2000**	**21**	**3**	**3 (1)**	**7 (4)**	**8 (3)**
Kyrgyziya	**Djalalabad**	**1999**	**19**	**3**	**2**	**4**	**10**
	*	**2000**	**22**	**4 (2)**	**3 (3)**	**6 (2)**	**9 (5)**
	Osh	**1999**	**23**	**3**	**6**	**3**	**11**
	*	**2000**	**17**	**4 (1)**	**4**	**3 (1)**	**6 (1)**
Tadjikistan	**Leninabad**	**1999**	**12**	**4 (1)**	**0**	**6**	**2**
	Sogdy **)	**2000**	**20**	**3**	**0**	**8 (6)**	**9 (8)**
	Khatlon	**1999**	**20**	**3 (1)**	**0**	**10**	**7**
	*	**2000**	**20**	**3 (1)**	**0**	**10 (1)**	**7 (3)**
Uzbekistan	**Ferghana**	**1999**	**20**	**3**	**0**	**9**	**8**
	*	**2000**	**20**	**3**	**0**	**8**	**9 (6)**
	Kashkadarya	**1999**	**20**	**3**	**0**	**7**	**10**
	*	**2000**	**21**	**3 (1)**	**0**	**7 (4)**	**11 (6)**
Region	**For the region:**	**1999**	**142**	**25**	**12**	**47**	**58**
		2000	**167 (80)**	**29 (10)**	**10 (4)**	**57 (22)**	**71 (44)**

*) The number of new participants started participating in the Competition since April, 1, 2000, is shown in the brackets
**) Leninabad oblast of the Republic of Tadjikistan was renamed into Sogdy oblast in autumn of the year 2000.

After the final seminar on the results of the first stage of the Competition, which was held in Chimkent on May, 12, 2000, Regional Monitor and Expert Consultant started getting acquainted with the peculiarities of the second stage of the Competition in oblasts – participants.
Together with National Monitors they were making assessments of the progress of the Competition. General attention was paid to the proposals on water saving, which according preliminary evaluation could be referred as original, “non standard” solutions possible to be implemented on broader scale at the regional level, and to assess the fact that facilitates sustainability of the achieved positive results.
During the visits to the objects of the Competition (**Table 2**) the assessment was given to the correctness of understanding by National Monitors, Oblast Managers and participants of objectives and tasks of the Competition, to the conditions of water measurements and reliability of those measurements.
During the period of assessment the interviews of competitors were carried out in order to investigate the specific conditions for the competition in particular object (what the incentives for water saving are, what is necessary that positive results could be sustainable, what is balking the initiatives and etc.)
As in 1999 after the completion of each two months periods the National Monitors were invited to Tashkent for a one or two days working seminars.
These seminars were prepared and conducted by the Regional Monitor’s Working Group and the WARMAP – 2 Project Team Leader. During the seminars the National Monitors submitted their reports for the two months periods, and they familiarized themselves with the tasks and objectives of the new stages of monitoring. After the completion of each seminar the ToR for forthcoming stages of work were agreed and signed. In order to have operative management of monitoring the E-mail connection with National Centers of Monitoring was organized.

Table 2. Trips of the Regional Monitor's Working Group

ITINERARY OF TRIPS	PERIODS OF TRIPS
South Kazakstan oblast	March, 06-09, 2000
Leninabad oblast	April,12-14, 2000
South Kazakstan oblast (Chimkent) *)	May, 11-12, 2000
Djalalabad, Osh, Ferghana oblasts	May, 23-31, 2000
South Kazakstan oblast	June, 22-25, 2000
Leninabad, Ferghana oblasts *)	July, 03-05,.2000
Osh oblast *)	July, 05-07, 2000
Djalalabad oblast*)	July, 08-09, 2000
Kashkadarya oblast	July, 10-15, 2000
South Kazakstan oblast *)	July, 12-13, 2000
Kzylorda oblast*)	July, 13-16, 2000
Ferghana oblast	July, 20-23, 2000
Djalalabad oblast	July, 31- August, 4, 2000
Osh oblast	August, 14-18, 2000
South Kazakstan oblast	September, 11-14, 2000
Leninabad oblast	September, 18-23, 2000
South Kazakstan oblast	December, 04-08, 2000

*) Itinerary of trips, in which the International Consultant of Monitoring, WARMAP – 2 Project Team Leader was participating.

1. CHARACTERISTICS OF VEGETATIVE PERIOD - 2000

The second stage of the Competition was going in the conditions of tough less water availability. Thus the external factors facilitated the situation that the competitors could practically demonstrate the realistic ways to overcome water crisis.

Less water availability of the year 2000 had aggravated greatly the problem of water managing complex functioning in the Syrdarya and the Amudarya rivers basins. Volume of water resources used by water users reduced significantly, ecological sustainability of river water systems also decreased. The necessity for distinct planning and correctness of the whole water managing complex management are greatly needed in the conditions of less water availability. The preciseness of planning, in its turn, is based on the reliability of hydrological forecasts, which are executed by Hydrometeorological service. Though, due to low equipment with tools and materials, reduction of functioning points of hydrological control, the information field had decreased, and that influenced greatly on the quality of forecasts.

So according forecasts of 1998 water availability during vegetative period in the Syrdarya river basin was expected about 81% from the norms, but actually it was 124%. In the result of this error the wrong plan of reservoir cascade operation was accepted, and in June, 1998 about 1 km3 of water was derived into Arnasai depression, and this is very unusual case for vegetative period.

And vice versa, during vegetative season of 2000 the actual volume of water resources in the Syrdarya river basin was 75% from the norm and 81% from predicted by Glavhydromet value (**Table 1.1**.).

There was even more dramatic situation in the Amudarya river basin. Actual volume of water resources of the Amudarya river basin was 71.8% from the norm and only 77.2% from predicted by Glavhydromet value.

Table 1. 1. Water resources of the Amudarya and Syrdarya river basins during vegetative period of 2000 (according the data of BVOs Amudarya and Syrdarya for the period from 01.04. 2000 till 30.09.2000)

Name	Unit of measure	Norm	Prediction	Actual	Deficit	
					From the norm	From prediction
The Amudarya river basin	Km3	47.592	44.261	34.182	13.410	10.079
The Syrdarya river basin	Km3	29.302	27.082	21.955	7.347	5.127
For two basins	Km3	76.894	71.343	56.137	20.757	15.206

On that background, during vegetative period the enforced derivation of water into Arnasai depression took place. The derivation of water into Arnasai is the result of Toktogul reservoir operation during winter period in hydropower generation mode and restricted capacity of the Syrdarya river bed downstream Charadara reservoir. During intervegetative period of 1999 – 2000 2.81 km3 of water was derived into Arnasai depression.

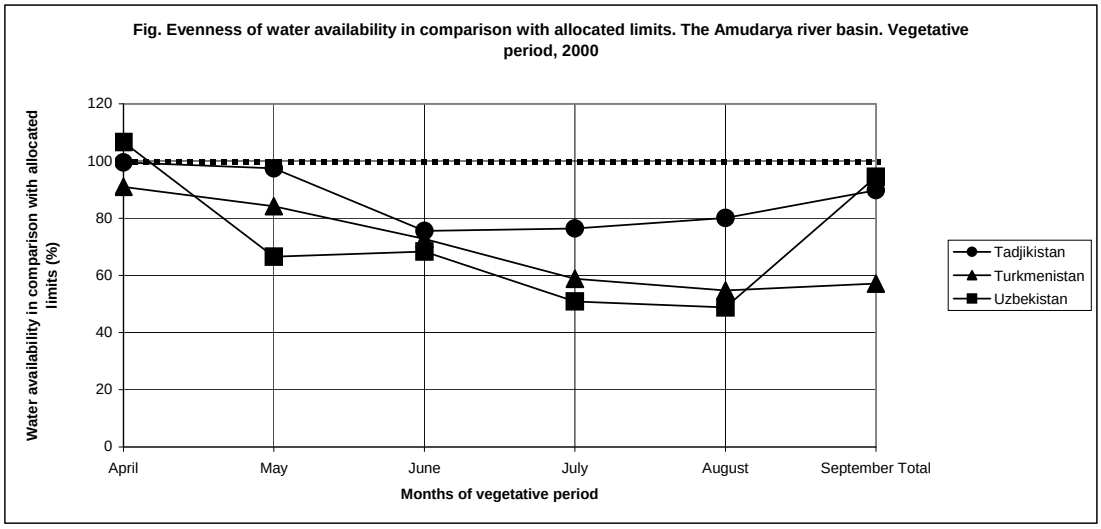
0.614 km3 (with the plan 3.0 km3) of water was delivered into the Aral Sea coast and into the Aral Sea on the Amudarya river basin, and 2.7 km3 (with the plan 2.8 km3) on The Syrdarya river basin. That meant that in summer the tensed ecological – epidemiological situation had taken place in the downstream of both basins, and especially in the Amudarya river basin.

On the background of such situation, water deliveries to the users were very uneven as for the whole vegetative period as well as during its most tensed periods (July – August) (**Table 1.2.**).

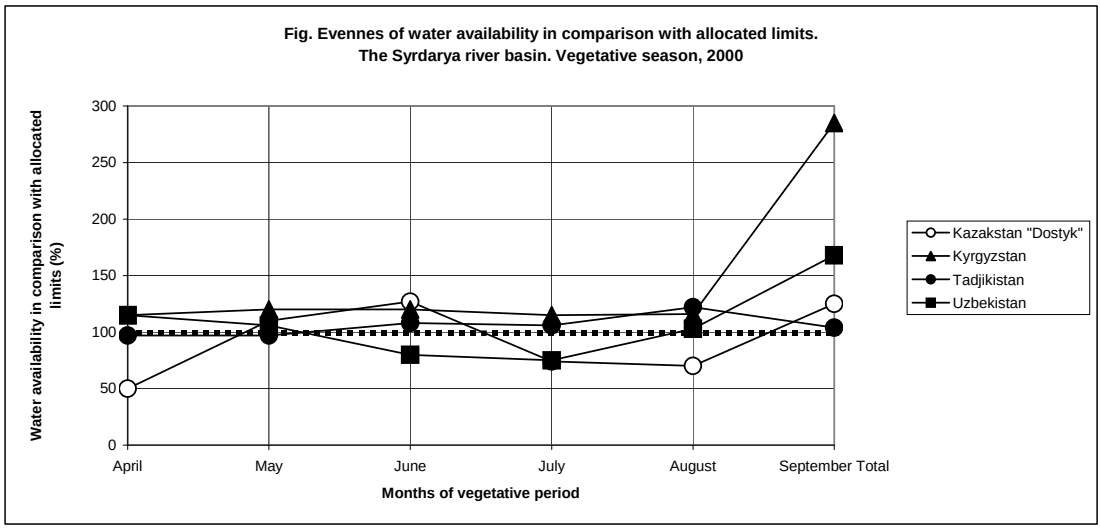
While compiling that section the materials of XXVIII Meeting of ICWC were used

Table 1.2. Evenness of water availability in the states of the Aral Sea basin during vegetative period of 2000 (in 5 in comparison with ICWC limits)

State	April	May	June	July	August	Septemb	VEGETATIVE
Amudarya river basin							
Tadjikistan	100	97	76	76	80	90	84
Turkmenistan	91	84	73	59	55	57	69
Uzbekistan	107	67	68	51	49	95	64



State	April	May	June	July	August	Septemb	VEGETATIVE
Syrdarya river basin							
Kazakhstan “Dostyk”	50	110	127	74	70	125	85
Kyrgyzstan	115	120	120	115	116	285	125
Tadjikistan	97	97	108	106	122	104	107
Uzbekistan	115	106	80	75	103	168	97



2. NATURE AND STRUCTURE OF PROPOSALS ON REDUCTION OF WATER LOSSES AND RATIONAL USE OF IRRIGATION WATER

Detailed description of the nature and structure of the Competition participants proposals regarding water savings, as well as the assessment of their actual implementation (area, where various measures were applied), are submitted in the reports of National Monitors. Each of those proposals, as a rule, includes several items, therefore we decided, that it is not advisable to include to the regional report the full list of proposals regarding all 167 objects. We will include only those of them, which could be of real interest for the development of regional water strategy.

Proposals, submitted by participants of the Competition, could be grouped into four main directions, presented in the **table 2.1**.

Table 2.1. Main water saving measures, applied by participants of the Competition

Technical	▪ Integrated or partial modernization of irrigation systems; ▪ Installation of impervious covers on canals; ▪ Land leveling of irrigated plots ▪ Improvement of water measuring level of irrigation systems
Technological	▪ Improvement of water measuring system ▪ Use of drainage water for irrigation ▪ Introduction of improved irrigation techniques and technologies ▪ Application of agro-technical methods for soils fertility enhancement ▪ Improvement of water allocation organization and technology ▪ Irrigation by short-cut furrows ▪ “stage” irrigation ▪ rotation of irrigated and “dry” row spaces ▪ application of film covers for furrow crests ▪ “night” irrigation ▪ water accumulating irrigation ▪ boundary use of discharges ▪ differentiated water deliveries (selective irrigation in accordance with the plant conditions) ▪ Planting on furrow crests ▪ Irrigation with changeable flow ▪ Use of drainage water mixed with irrigation water
Organizational	▪ Improvement of organizational management structures in the conditions of market economy ▪ Establishment of water users associations in the irrigated farming ▪ Changing of cropping patterns and areas structure (introduction of drought-resistant and salt-resistant crops in the crop rotation); ▪ Adaptation of cropping pattern structure to the conditions of limited water use. ▪ Organization of irrigation at on-farm level in the conditions of measured water deliveries (field – “indicators”) ▪ “concentrated” irrigation ▪ organization of inter-farm and on-farm water rotation ▪ organization and implementation of “night” irrigations ▪ water deliveries only under the condition if the fields are ready for irrigation
Economic	▪ economic stimulation of water savings in the conditions of strict limitation on technological water demands, with minimum payment by water users for the share, corresponding to the “norm” – biological water demand level for a particular crop, and higher payment for surplus water, due to improper water management at the farm – field level

In accordance with PA “Uzvodoproject” estimates, maximum possible reduction for all types of losses by the elements of irrigation systems are the following:

- up to 25 % on fields (irrigation technique);
- up to 30 % - in the on-farm irrigation network;
- up to 45 % - inter-farm and main canals.

With that necessary investments for the reduction of losses are:

- 0.9 $ /m^3 for fields;
- 1.4 $ /m^3 for on-farm irrigation network;
- 0.5 $ /m^3 for inter-farm and main canals.

A number of quite simple and inexpensive methods for water savings, to some extent, increase the efficiency of water use and productivity of irrigation, however it is evident, that large-scale water savings and land quality improvement could be achieved only by the significant investments into irrigation infrastructure and technology.

Value of works, being carried out during the monitoring of the Competition, is, first of all, the revelation of positive and remained experience, which is initiated by water users themselves, without any interference from the “top”. Therefore, we are talking not about scientific experiments, which farmers and agricultural cooperatives are ready to carry out if they have incentives, but about methodologies, found by themselves in specific conditions of irrigated farming on their fields, as measures for rational use of water resources. It should be clearly understood, that activities, carried out by water users for water savings, are not experiments, dictated from the “top”, but a specific practice of irrigated farming in particular zones of the oblast. These activities could be extended, if initiatives would be duly assessed and stimulated. Such understanding is also important from the position of the evaluation of water savings sustainability, since it is obvious, that demonstrated practice of water savings was established before the Competition, and will exist after its completion. The Competition only promoted stimulation of further extension and public awareness of practical water savings methodologies. One of the important achievements of the Competition is gradual change of attitude to water as to an inexhaustible resource. The Competition stimulated the increase of water measuring level in on-farm irrigation networks of Fergana, Djalalabad, Osh and Sogdy oblasts.

The main stimulating factors for water resources savings at the present stage of economic and social development of the Central Asian states are presented in the **table 2.2**.

Table 2.2. Main stimulating factors for water resources savings for the "Water Saving Competition" objects within A-2 Subcomponent

	Main stimulating factors for water resources saving	Zones of actual factor's impact in the Competition objects
1	Low water availability of irrigation systems	▪ Kashkadarya oblast ▪ South Kazakhstan oblast ▪ Sogdy oblast
2	Chargeable water use	▪ Kizilorda oblast ▪ South Kazakhstan oblast ▪ Osh oblast ▪ Djelalabad oblast ▪ Sogdy oblast ▪ Khatlon oblast
3	Public awareness of the necessity for the reduction of irrigation water use	▪ Fergana oblast ▪ Djelalabad oblast

Note: Factors are shown in the order of their impact on water savings.

The **table 2.3** summarizes data regarding the most prevailing water saving methods and their characteristics, demonstrated within the framework of the A-2 Subcomponent, which could be recommended for popularization by the Component B of GEF Project, and for propagation in the region.

Table 2.3 Analytical recommendations on practical technologies for water saving (not requiring additional capital costs for their implementation), which were demonstrated within Subcomponent A-2

№ №	Applied technology of water saving	The gist of technology	Water saving effect, in comparison with usual irrigation technique	The zone of actual use on the Competition objects
1	Irrigation with alternation of irrigated and dry space between rows	With technology of irrigation during the period of anthesis (fruit formation) of irrigated and dry space between rows, depending upon the width of space between rows 60 cm or 90 cm, the furrows are being cut with the width of 120 cm or 180 cm correspondingly. Non-irrigated space between rows is supported by cultivations in crumbly condition, and by that promoting favorable air and gas exchange in the rooting zone of crop. Fertilization of non-irrigated space between rows prevents soil washing beyond rooting zone, and by that it increases the efficiency of fertilizers use. Irrigation with space between rows facilitates equilibrium of crop growing and development. Bushes of cotton with the use of that technology are not high with well developed rooting system.	Water saving effect is proved out that in comparison with irrigation into each furrow, with which physical evaporation takes place actually on the whole moistured surface of the field, with that irrigation technique, for the account of inside capillary distribution of moisture towards the sides of irrigated furrow, the strips with the width 1.3 – 1.4 m (with space between rows 0.9 m) and 0.9 m (with space between rows 0.6 m) are being moistured. The strips with the width of 0.4 – 0.5 m (with space between rows 0.9 m) and about 0.3 m (with space between rows 0.6 m) stay dry and crumbly, and losses for non productive physical evaporation from them are practically close to zero. Due to reduction of physical evaporation from soil surface for 20 – 25%, the total water use is being reduced. In comparison with water delivery into each furrow **irrigation water savings reach 20 – 25%.**	It is widely used on the Competition objects of the following oblasts: ▪ Ferghana ▪ Kashkadarya ▪ Sogdy ▪ Osh ▪ Djalalabad ▪ South Kazakstan
2	Stepped irrigation in furrows with inside use of the formed escapes	With stepped irrigation the irrigated field is divided into 3 – 4 steps, the distance between steps is defined by furrow length. As a rule, the furrows are short 60 – 100 m. There several schemes for the oganisation stepped irrigation. The most common scheme is that when field canals are traced to the center of irrigated plots. Irrigation of short furrows 60 – 100 m starts from the first step, and on the next step the heads of furrows are being filled. After the lag of irrigation streams to the outlet furrow of the	Water saving effect proves out in **the reduction of losses for surface escape beyond the boundaries of irrigated field for 15 – 20% (from total water delivery),** as non used in the present irrigation scheme surface escape is formed only in the last step. In the zone of medium and steep and heightened slopes with stepped location of fields and field canals the surface escape from upper fields is directed into lower located field canals. The coefficient of irrigation water use with stepped scheme of irrigation within big farms is close to 1.	It is widely used in the Competition objects located on the irrigated lands with medium and heightened slopes, in the following oblasts: ▪ Ferghana ▪ Kashkadarya ▪ Sogdy ▪ Osh ▪ Djalalabad

№ №	**Applied technology of water saving**	**The gist of technology**	**Water saving effect, in comparison with usual irrigation technique**	**The zone of actual use on the Competition objects**
		second step, the formed escape is directed into outlet furrow and adds the discharge from field canal. In such order the irrigation on the following steps is being carried out. Stepped irrigation allows to reach even moistening of irrigated plot and to reduce significantly surface escape, as escape takes place only from the furrows of the last step beyond the field.		▪ Khatlon
3	Concentrated irrigation and water rotation	With the organization of concentrated irrigation the order of irrigation is being established between irrigated plots. The whole discharge of plot water storage is directed to the alternate plot. Planting is planned in such a way that the dates of irrigation of each irrigated plot within inter – irrigation period could be carried out close to the optimal dates. Water rotation is used while irrigating of big units of water use.	With the concentrated water delivery **the organizational losses are reduced for 10 – 20% (from total water delivery),** and they make 30 - 35% from water delivery into irrigated scheme with “dispersion” of water delivery through the majority of outlets.	It is widely used on the Competition objects in the following oblasts: ▪ Ferghana ▪ Kashkadarya ▪ Sogdy ▪ Osh ▪ Djalalabad ▪ South Kazakstan ▪ Khatlon
4	Irrigation with rotational stream	While irrigating with rotational stream, after the lag of the head of irrigation stream to the end of furrow, the stream drops down nearly twice in accordance with reducing intensity of absorption. The evenness of moistening along furrow length is increasing. The conditions for even development of crop are being created.	Water saving effect proves out in **the reduction of losses for surface escape beyond furrow for 15 – 20% (from total water delivery)**.	It is widely used on the Competition objects in the following oblasts: ▪ Ferghana ▪ Kashkadarya ▪ Sogdy ▪ Osh ▪ Djalalabad ▪ South Kazakstan ▪ Khatlon
5	Covering crests with polyethylene film	With this technology space between rows, during the process of planting, is covered with thin (8 – 10 micrometer) polyethylene	Water saving effects is proved out by the fact that with film cover of space between rows the total water consumption of cotton is reduced for	It is widely used on the Competition objects in the following oblasts:

№ №	Applied technology of water saving	The gist of technology	Water saving effect, in comparison with usual irrigation technique	The zone of actual use on the Competition objects
		film with the width of 60 cm. Due to the increase of temperature of surface layer of soil under the film, there is the opportunity to carry out planting 2 – 3 weeks earlier than usually recommended dates, and as a result to get rather earlier expected yields and to complete their harvesting before the period of autumn rainfalls.. The temperature and moisture regime under the film allows to promote germination with natural moisture without pre-irrigation. Besides in the fields with film cover there are favorable conditions for fast growing of plants and their development, and there are favorable conditions allowing to obtain up to 25% extra yields with earlier matured cotton fiber of high quality. Also the number of cultivations is reduced and F&L are saved.	20 – 25% due to reduction of physical evaporation from soil surface, and the number of necessary vegetative irrigations is reduced for 1.5 times. In comparison with usual technology of planting there is **irrigation water saving for 30 – 35%.**	▪ Sogdy ▪ Osh ▪ Djalalabad
6	Use of drainage water for irrigation	In order to increase water availability of irrigated lands with low water availability they install mobile pumping stations on collectors for additional pumping into irrigation network. In order to prevent salinity processes the proportion for mixture of drainage water with irrigation water is being controlled.	Water saving effect is proved out in **the increase of the coefficient of irrigation water use up to 1.**	It is widely used in rice systems of Kzylorda oblast and in tail sections of irrigation systems in the following oblasts: ▪ Ferghana ▪ Kashkadarya ▪ Sogdy

Note: The technologies are given in the order of their labor input and distribution in the Competition objects. In many objects of the Competition they apply several of the shown technologies.

3. REVIEW AND ANALYSIS OF DATA CHARACTERIZING THE ACTIVITIES ON WATER SAVINGS AND RATIONAL WATER USE

3.1. Main provisions

The concept of water saving in irrigated agriculture, especially in conditions of market economy, has more widely meaning, than simple reduction of the charges for water taken away from water sources. The system of water savings includes a wide circle of matters: optimisation of land reclamation modes on the background of drainage and irrigation technique, agro technical methods, raising fertility of soils, the improvement of irrigation engineering and technology, etc. The purpose of water savings on irrigated lands is the organisation of agricultural production, which provides rational use of irrigation water in order to reach the optimum level of yields and correspondingly the benefit from agricultural production.

The successfulness and sustainability of practical demonstration by the participants of the Competition of the methods for improvement of agricultural inputs use and crop yields increase (socio – economic aspects) with simultaneous reduction of non productive irrigation water use (ecological aspect) were assessed from such positions.

Relatively detailed estimations of Stage II of the Competition results for all categories of the participants are included in the reports of National Monitors, the most important ones are generalised and analysed by us and they are given in the Annexes to the present report.

It is pertinent to stop in more details on the basic tendencies, which were shown within two years of the Competition. In this connection, we will consider interrelation between the elements of water saving system, such as:

- Cropping patterns on irrigated lands
- Volumes of saved water resources during vegetative period
- Main crops yields
- Gross output
- Costs for agricultural production
- Gross benefit
- Land and water use productivity.

3.2. Cropping patterns on irrigated lands.

In comparison with 1999, the areas of irrigated land in contours, which are command to rayon water managing organisations - participants of Water Saving Competition, have increased for 161.3 thousand ha. This growth is connected mainly with increasing the number of participating in the Competition water managing organisations, and also with the substitution of the excluded from the Competition organisations by the others. Though as in 1999 the main crops of the region in 2000 are represented: by cotton - 33.8 % from total irrigated area (in 1999 - 37.5%); by winter wheat - 17.9 % (in 1999 - 19.5 %); by lucerne - 10.5 % (in 1999 -7.0 %); by rice - 6.8 % (in 1999 - 3.3 %) **(table 3.1 and figure 3.1).** More detailed characteristics of cropping patterns on irrigated lands for various categories of the participants of the Competition are presented in the **Annex B**.

The highest share of cotton in cropping patterns has South-Kazakstan Oblast - 61.2 %; winter wheat - Osh Oblast - 31.3 %; lucerne - Kzylorda Oblast - 30.3 %; rice - Kzylorda Oblast - 41.3 %.

Table 3.1. Cropping patterns on irrigated lands, which are command to water managing organisations - participants of Water Saving Competition.

Oblast	Year	Irrigateed area (ha)	including:											
			cotton	wheat	lucerne	maize for grain	maize for silage	rice	sunflower	potato	tobacco	orshards	vegetables and melons	others
Kzylorda	1999	68.7	0.0	7.2	16.3	0.5	0.0	28.6	0.0	0.0	0.0	0.0	7.2	40.2
	2000	132.0	0.0	9.1	30.3	0.4	0.0	41.3	0.3	3.6	0.0	0.6	7.0	7.3
South Kazakstan	1999	184.9	66.1	8.6	9.3	1.8	0.0	1.2	0.0	0.0	0.0	0.0	6.7	6.4
	2000	203.5	61.2	10.9	11.5	0.3	0.0	1.0	0.2	0.0	0.0	0.0	5.5	9.4
Djalalabad	1999	47.2	15.3	30.5	0.0	4.3	0.0	0.0	4.4	0.0	4.9	0.0	3.7	36.8
	2000	86.6	20.8	19.3	0.1	5.2	0.0	0.0	1.5	1.2	4.0	0.0	4.8	43.2
Osh	1999	91.5	12.3	28.1	0.0	5.9	15.8	0.0	0.0	0.0	5.1	0.0	0.0	32.8
	2000	83.0	12.9	31.3	0.0	6.1	0.0	0.0	0.0	0.0	4.0	0.0	0.0	45.7
Sogdy	1999	39.9	39.7	16.6	11.1	0.0	0.0	0.0	0.0	0.0	0.0	20.2	3.4	9.1
	2000	69.9	36.6	10.4	6.2	0.0	0.0	0.0	0.0	0.0	0.0	23.6	3.4	19.8
Khatlon	1999	49.8	54.0	16.5	6.8	0.0	0.0	1.5	0.0	0.0	0.0	1.0	0.6	19.6
	2000	79.9	51.2	17.9	6.7	0.3	0.0	0.5	0.0	0.0	0.0	0.0	0.6	22.8
Ferghana	1999	85.5	36.5	22.6	2.7	2.3	0.0	0.0	0.0	0.0	0.0	9.5	1.6	24.8
	2000	79.1	38.9	25.2	3.0	2.0	0.0	0.0	0.0	0.0	0.0	10.4	1.7	18.8
Kashkadarya	1999	111.5	36.2	33.3	8.3	1.1	0.0	0.0	0.0	0.0	0.0	3.9	2.6	14.7
	2000	106.0	31.5	30.5	12.1	1.7	0.0	0.0	0.0	0.0	0.0	8.1	1.4	14.6
REGION	1999	678.9	37.5	19.5	7.0	2.1	2.1	3.3	0.3	0.0	1.0	3.1	3.7	20.3
	2000	840.1	33.8	17.9	10.5	1.7	0.0	6.8	0.3	0.7	0.8	4.1	3.6	19.8

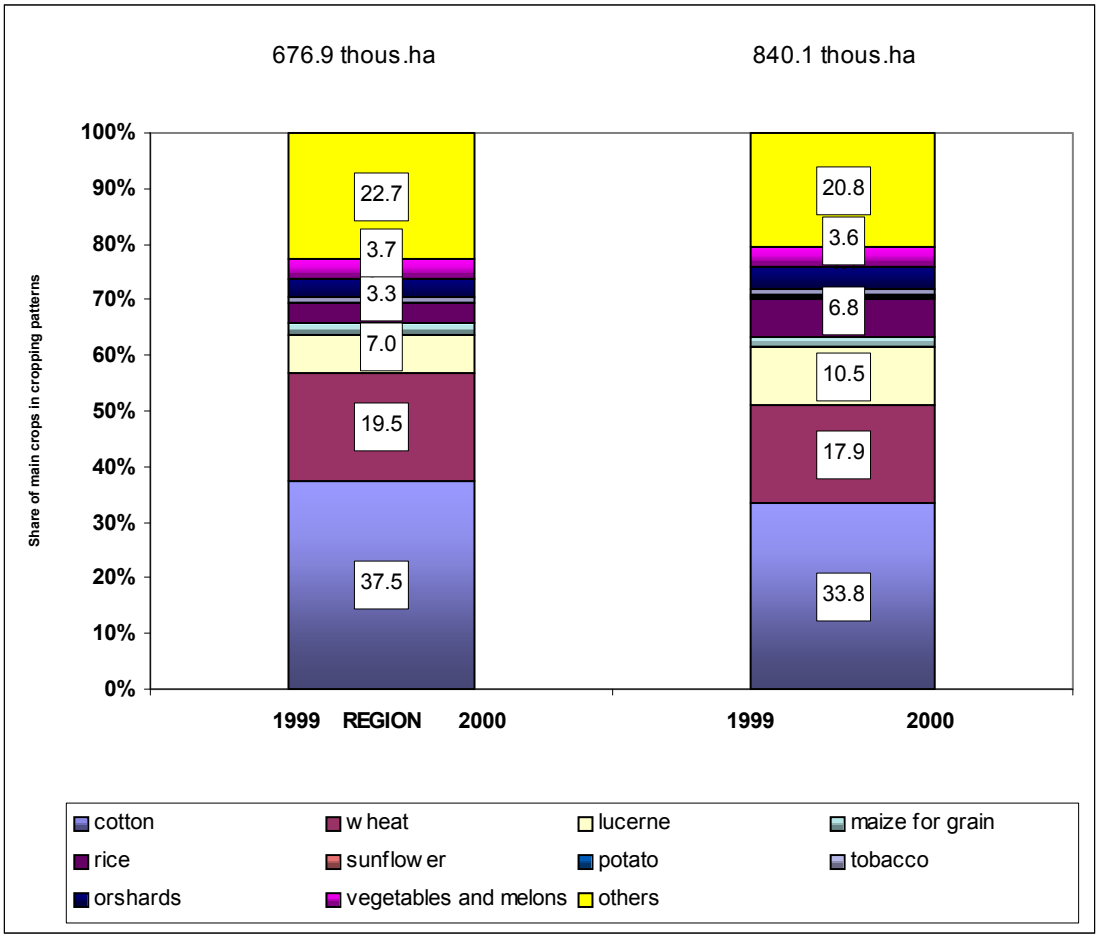


Fig. 3.1. Cropping patterns on irrigated lands

3.3. Volumes of water resources savings during vegetative period

As the parameter describing irrigation water savings the difference between actual intake for irrigation and the limit established for vegetative season 2000 was used **(Annex C).**
Limits of intake for complex hectare were in average 13.34'000 m^3/ha (compared with 12.60 '000 m^3/ha in 1999), i.e. had increased for 74 '000 m^3/ha **(table 3.2).** The growth of limits of intake mainly took place due to the increase of limits for complex hectare for water managing organisations participating in the Competition of 2000 from Osh, Sogdy, Khatlon and Kashkadarya oblasts.
The reduction of actual volumes of water per complex hectare at the level of intakes into rayon water managing organisations as a whole for the region in comparison with 1999 was not much, it was 0.36 '000 m^3/ha (i.e. within the accuracy of water measurements). Thus in three oblasts the actual volumes of water per complex hectare had increased in 2000 had increased:

- in Khatlon Oblast for 1.95 '000 m^3/ha (16.75 '000 m^3/ha in 2000 compared with 14.80 '000 m^3/ha in 1999);
- in Sogdy Oblast for 1.08 '000 m^3/ha (15.11 '000 m^3/ha '000 m^3/ha in 2000 compared with 14.03 '000 m^3/ha in 1999);
- in Osh Oblast for 0.72 '000 m^3/ha (9.07 '000 m^3/ha in 2000 compared with 8.35 '000 m^3/ha in 1999).

The total reduction of actually withdrawn volumes from water sources in comparison with the allocated limits as a whole for the region was 2.6 km^3(compared with 1.4 km^3 in 1999) or for complex hectare 3.09 '000 m^3/ha (compared with 2.00 '000 m^3/ha in 1999) **(fig. 3.2).**

Table 3.2. The volumes of intakes reduction compared with allocated limits for vegetative season (at the level of rayon water managing organisations - participants of the Competition)

Oblasts	Year	Vodkhozes						
		Net irrigated area, ha	Water volume allocated according limit (mln.m^3)	Specific water volume allocated according limit (000m3/ha)	Actually received water volume (mln.m^3)	Actual specific irrigation water volume (000m3/ha)	Saved water volume in comparison with limit (mln.m3)	Actual specific volume of saved irrigation water in comparison with limit (000m3/ha)
Kzylorda	1999	68717	1811.20	26.36	1688.38	24.57	122.82	1.79
	2000	132016	3379.10	25.60	2717.92	20.59	661.18	5.01
South Kazakstan	1999	184878	2499.07	13.52	1793.32	9.70	705.75	3.82
	2000	203527	1861.00	9.14	1068.03	5.25	792.97	3.90
Djalalabad	1999	47223	451.17	9.55	354.17	7.50	96.99	2.05
	2000	86587	775.80	8.96	617.50	7.13	158.30	1.83
Osh	1999	91497	994.64	10.87	764.00	8.35	230.64	2.52
	2000	83022	918.55	11.06	752.98	9.07	165.58	1.99
Sogdy	1999	39851	757.79	19.02	559.11	14.03	198.68	4.99
	2000	69949	1460.37	20.88	1057.15	15.11	403.22	5.76
Khatlon	1999	49802	769.51	15.45	737.07	14.80	32.44	0.65
	2000	79870	1461.88	18.30	1337.63	16.75	124.25	1.56
Ferghana	1999	85454	594.61	6.96	621.25	7.27	-26.64	-0.31
	2000	79144	500.98	6.33	504.20	6.37	-3.22	-0.04
Kashkadarya	1999	111478	679.54	6.10	684.47	6.14	-4.94	-0.04
	2000	106030	853.00	8.04	558.90	5.27	294.10	2.77
REGION	1999	678900	8558	12.60	7202	10.61	1356	2.00
	2000	840145	11211	13.34	8614	10.25	2596	3.09

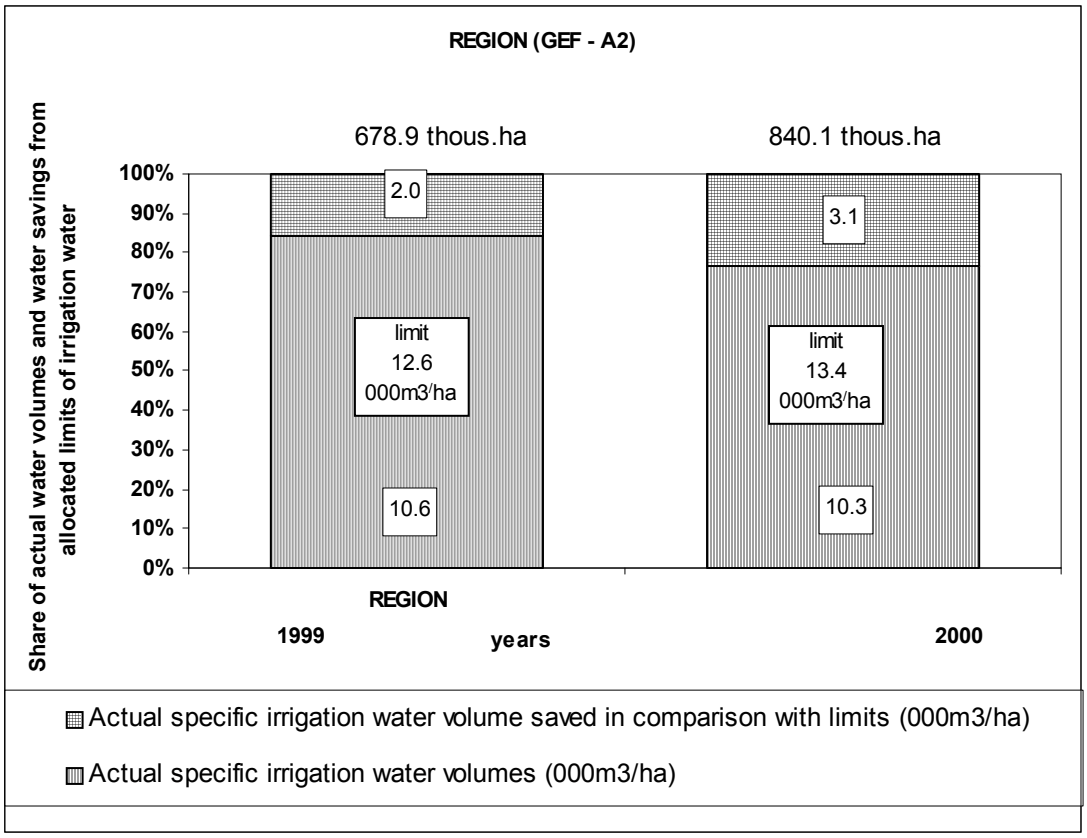


Fig. 3.2. Volumes of intake reduction compared with allocated limits for vegetative period

According the oblasts - participants of Competition (while estimating at the level of water managing organisations - participants of the Competition) the "contributions" into the reduction of intakes were distributed as follows:

Kzylorda oblast – 25 %
South Kasakstan oblast – 31 %
Djalalabad oblast – 6 %
Osh oblast – 6 %
Sogdy oblast – 16 %
Khatlon oblast – 5 %
Ferghana oblast – 0 %
Kashkadarya oblast – 11 %

And with all that, if to consider main conditions facilitating such reduction, it is possible to outline four of them in order of priority of their influence:

- absence of physical opportunity for the intake of allocated water limits due to the lack of water in the sources or absence of necessary command levels of water in them
- excess of the allocated limits above real crop water requirements
- the desire of water users to reduce payments for irrigation water (Kasakstan, Kyrgyzstan)
- understanding of the necessity for water savings, especially in the conditions of less water availability.

From this view point the attempt to estimate approximately the actual efficiency of water resources use during vegetative season of 2000 on the basis of generalised within the each oblast data of rayon water managing organisations – participants of the Competition.

While analysing cropping patterns and using for the assessment of water requirements the irrigation norms of vegetative period - "net - field" given in the reports of National Monitors, the recommended by some authors index – Water Use Coefficient in irrigation systems (intake into rayon – irrigated fields) was approximately assessed and compared similar indicesr for 1999 **(Table 3.3.).**

.

$$WUC = \frac{r * F}{W}$$

where

WUC - Water Use Coefficient in irrigation systems
r - useful water consumption by the crops, irrigation norm "net",m³/ha
F - irrigated area of the system, ha
W - volume of intake into irrigation system, m³

Table 3.3. Estimation of irrigation water use efficiency

Oblast	Years	Irrigated area	Average weighted norm "net - field" of complex hectare	Established limit of specific intake for complex hectare	Actual specific intake	Water Use Coefficients in irrigation systems corresponding to the established limits	Actual Water Use Coefficients in irrigation systems	Difference between actual and established according limit Water Use Coefficients
		000 ha	000 m3/ha	000 m3/ha	000 m3/ha	%	%	%
Kzylorda	1999	68.72	13.6	26.4	24.6	51.7	55.5	3.8
	2000	132.02	15.5	25.6	20.6	60.7	75.4	14.8
South Kazakstan	1999	184.88	5.1	13.5	9.7	37.8	52.6	14.9
	2000	203.53	5.3	9.1	5.3	58.3	101.4	43.2
Djalalabad	1999	47.22	4.7	9.6	7.5	48.7	62.0	13.3
	2000	86.59	4.8	9.0	7.1	53.7	67.5	13.8
Osh	1999	91.50	4.8	10.9	8.4	44.5	57.9	13.4
	2000	83.02	3.9	11.1	9.1	35.5	43.3	7.8
Sogdy	1999	39.85	7.3	19.0	14.0	38.6	52.3	13.7
	2000	69.95	7.3	20.9	15.1	34.8	48.1	13.3
Khatlon	1999	49.80	6.3	15.5	14.8	40.5	42.3	1.8
	2000	79.87	5.9	18.3	16.8	32.1	35.1	3.0
Ferghana	1999	85.45	3.9	7.0	7.3	56.1	53.7	-2.4
	2000	79.14	4.0	6.3	6.4	62.9	62.5	-0.4
Kashkadarya	1999	111.48	5.0	6.1	6.1	81.7	81.1	-0.5
	2000	106.03	5.1	8.0	5.3	63.5	96.8	33.4
REGION	1999	678.90	5.9	12.6	10.6	47.2	56.0	8.9
	2000	840.15	6.8	13.3	10.3	50.9	66.3	15.4

Normal values of Water Use Coefficient in irrigation systems – WUC are 55 - 65 %. (with the efficiency of main, inter-farm and on-farm canals system at the level of 65 % -75 % and efficiency of water use in the field at the level of 75 - 85 %)
WUC values less than 55 % witness about not enough effective water use and available reserves for water savings.
WUC values more than 65 % witness about secondary irrigation water use within contours in the conditions of its deficit.
WUC values more than 75 % witness about "strict" deficit of irrigation water and low level of water availability for crops.

Based on that criteria the following water managing organisation carried out their activities in the conditions of “strict” water deficit :

- South Kasakstan oblast (WUC =101 %), especially strict water deficit was marked here in the zone of the "Dostyk" canal;
- Kashkadarya oblast (WUC =97 %);
- Kzylorda oblast (WUC =75 %).

Rational water use had been demonstrated by the following water managing organisations:

- Djalalabad oblast (WUC =68 %);
- Ferghana oblast (WUC =63 %).

The following water managing organisations, which have some reserves for water savings, had worsened their indices in comparison with 1999:

- Khatlon oblast (WUC =35 % compared with 43 % in 1999);
- Osh oblast (WUC =43 % compared with 58 % in 1999);
- Sogd oblast (WUC =48 %, compared with 52 % in 1999).

3.4. Yields of main agricultural crops

The purpose of irrigated farming is the achievement of optimum level yields with rational use of irrigation water. From these positions the efficiency water saving measures is estimated by “payment" of irrigation water use for the yield. The data about crop yields , obtained by various categories of water users – participants of the Competition, are shown in **Annex D**. Let's consider in more details the general endencies revealed during the Competition, and especially , as far as less water availability during vegetative season of 2000 had an impact on main crops yields for the region **(Table 3.4.)**.

Cotton

In the category *“ kolkhozez, agricultural cooperatives”* the yields of crops in the objects of the Competition were higher or at the level of 1999 in the following oblasts:

- Ferghana oblast – 3.45 ton/ha compared with 3.26 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 2.82 ton/ha);
- Sogdy oblast – 3.00 ton/ha compared with 2.30 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 2.15 ton/ha) ;
- Kashkadarya oblast – 2.73 ton/ha compared with 2.43 ton/ha in 1999 (crop yields at the level of rayons in 2000 . – 1.98 ton/ha);
- Djalalabad oblast – 2.60 ton/ha compared with 2.60 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 2.47 ton/ha);
- South Kasakstan oblast – 1.8 ton/ha compared with 1.54 ton/ha in 1999 (crop yields at the level of rayons in 2000 . – 1.76 ton/ha).

In the farms of Khatlon oblast the crop yield of 1.44 ton/ha is higher than average rayon indices – 1.23 ton/ha, but lower than in average for farms - participants of the Competition from this oblast in 1999 – 1.60 ton/ha.

In the category *“private farms and peasant farms”* the crop yields above average rayon indices and above indices of 1999 were obtained by the following competitors:

- Ferghana oblast – 3.73 ton/ha compared with 3.25 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 2.82 ton/ha);
- Sogdy oblast – 3.16 ton/ha compared with 1.63 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 2.15 ton/ha) ;
- South Kasakstan oblast – 2.49 ton/ha compared with 1.84 ton/ha in 1999 г. (crop yields at the level of rayons in 2000 – 1.76 ton/ha).

The indices of private farms were a bit reduced in comparison the last year:

- Osh oblast – 3.30 ton/ha compared with 3.35 ton/ha in 1999 г. (crop yields at the level of
- rayons in 2000 – 3.30 ton/ha);
- Kashkadarya oblast – 2.90 ton/ha compared with 3.00 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 1.98 ton/ha);
- Djalalabad oblast – 2.70 ton/ha compared with 2.67 ton/ha in 1999 г. (crop yields at the level of rayons in 2000 – 2.47 ton/ha).

Especially significant reduction was private farms of Khatlon oblast - 1.48 ton/ha compared with 2.34 ton/ha in 1999 (crop yields at the level of rayons in 2000 - 1.23 ton/ha).

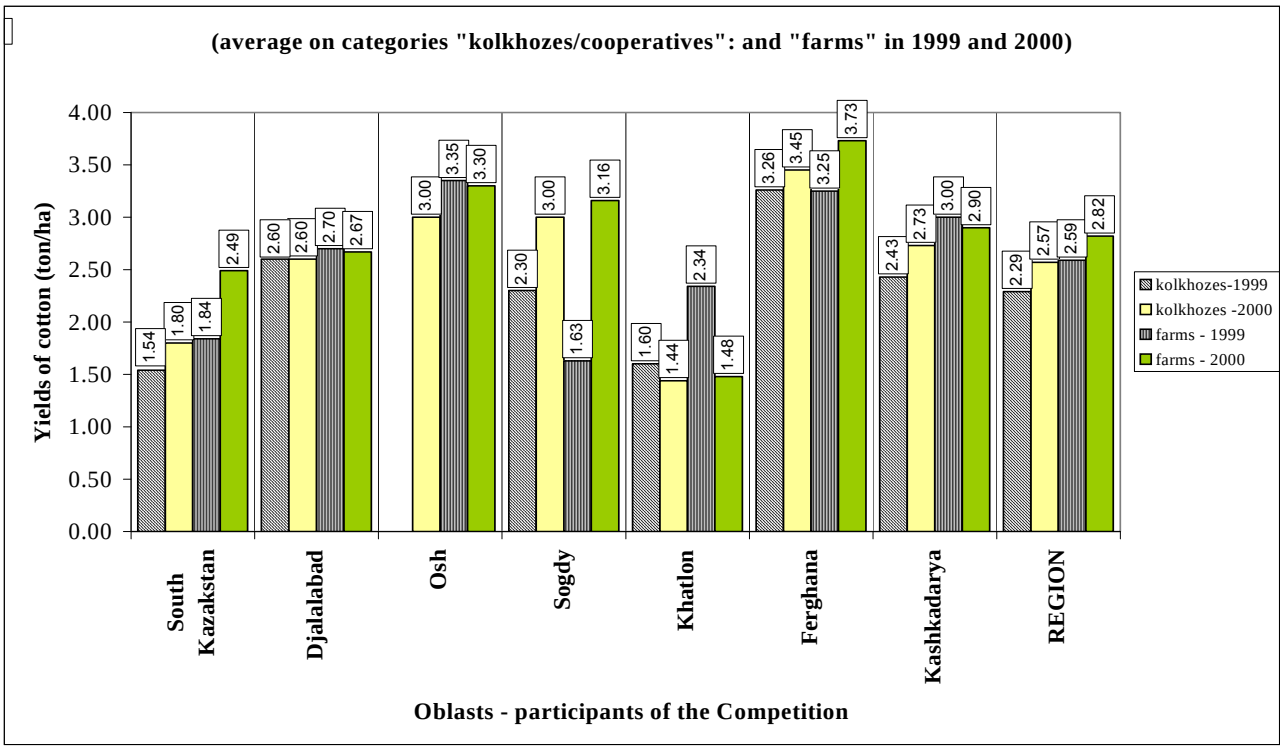


Fig. 3.3. Yields of cotton

Winter wheat

In the category *" kolkhozes, agricultural cooperatives "* the yields in the objects of the Competition are higher than average rayon indices and higher than the indices of 1999:

- Ferghana oblast – 4.86 ton/ha compared with 3.60 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 3.47 ton/ha);
- Osh oblast – 4.25 ton/ha compared with 3.45 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 3.25 ton/ha);
- Khatlon oblast – 1.76 ton/ha compared with 1.71 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 1.62 ton/ha).

The indices for Kashkadaya oblast were decreased – 2.44 ton/ha compared with 2.63 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 2.31 ton/ha).

The yields in the following objects of the Competition are below than indices of 1999 and below the level of rayons:

- Djalalabad oblast – 3.43 ton/ha compared with 3.47 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 3.85 ton/ha);
- Sogdy oblast – 2.89 ton/ha compared with 3.08 ton/ha in 1999;
- South Kasakstan oblast – 1.97 ton/ha compared with 2.04 ton/ha 1999 (crop yields at the level of rayons in 2000 – 2.17 ton/ha) ;

Especially significant reduction of yields was in the farms of Kzylorda oblast - 0.88 ton/ha compared with 2.27 ton/ha in 1999 (crop yields at the level of rayons in 2000 - 0.96 ton/ha).

In the category *" private farms and peasant farms "* the following competitors obtained yields higher than average rayon indices and higher than the indices of 1999:

- Ferghana oblast – 3.55 ton/ha compared with 3.19 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 3.47 ton/ha);

- Kashkadarya oblast – 3.31 ton/ha compared with 2.45 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 2.31 ton/ha) ;
- Sogdy oblast – 2.70 ton/ha compared with 1.50 ton/ha in1999.
- Khatlon oblast – 1.76 ton/ha compared with 1.61 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 1.62 ton/ha).

In Djalalabad oblast the yield was 3.47 ton/ha, it is higher than in 1999 r. – 2.73 ton/ha, but it is lower than yields at rayon level in 2000 – 3.85 ton/ha.

In Osh oblast the yield was 3.67 ton/ha, which is a bit lower than in 1999 – 3.73 ton/ha, but it is higher than yields at rayon level in 2000 – 3.25 ton/ha.

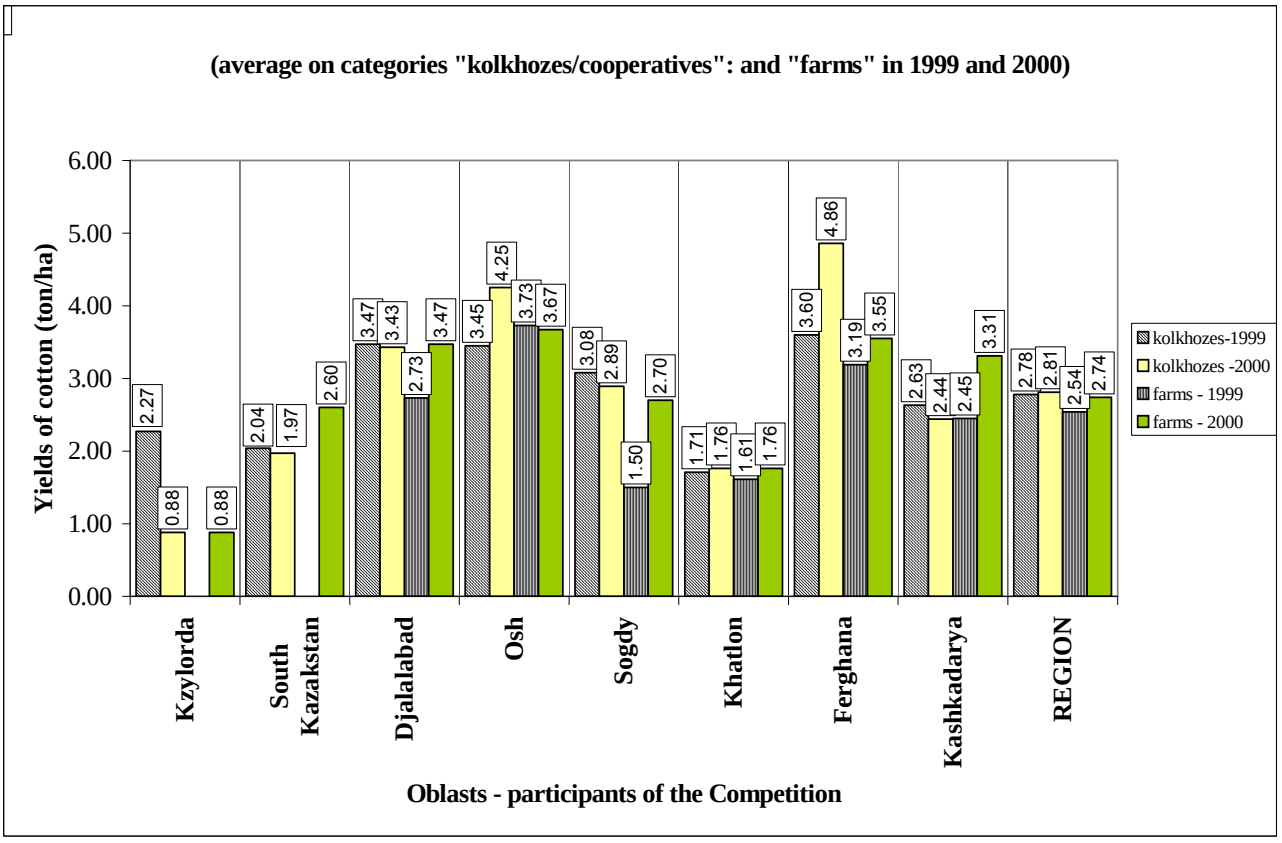


Fig. 3.4. Yields of winter wheat

Rice

In the category *" kolkhozes, agricultural cooperatives "* the following competitors obtained the yields, which were higher than average indices for rayons and higher than the indices of 1999:

- Kzylorda oblast – 4.03 ton/ha compared with 3.75 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 3.93 ton/ha);

The yields were lower than the indices of 1999 and lower than average rayon indices in the following objects of the Competition:

- South Kasakstan oblast – 2.12 ton/ha compared with 2.13 ton/ha in 1999 (crop yields at the level of rayons in 2000 – 3.17 ton/ha).

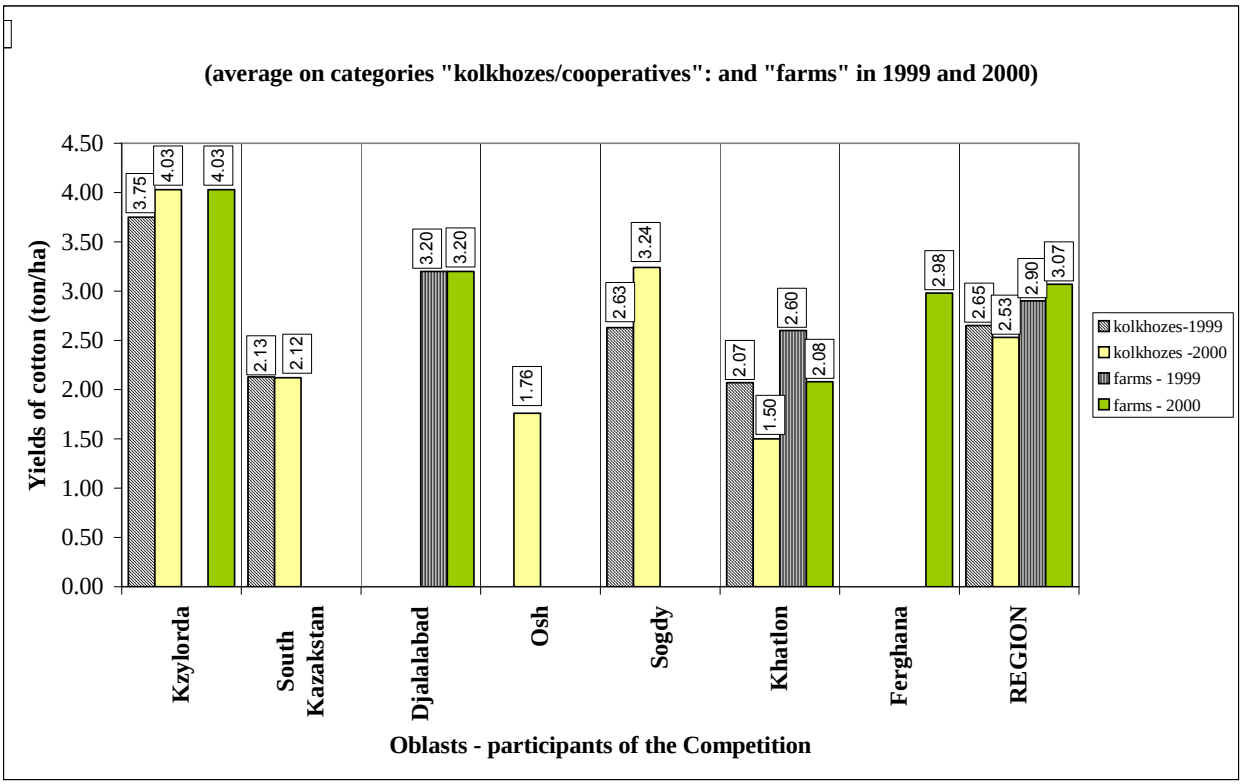


Fig. 3.5. Yields of rice

While summarising the data on the yields of main crops, it is possible to mark, that as a whole less water availability had no significant influence on the level of main crops yields of the objects of the Competition, except for greater decrease of winter wheat yields in the Kzylorda oblast (downstream the Syrdarya river basin) and some reduction of yields in Kashkadarya oblast (midstream the Amudarya river basin).

Rather than water factor, as the level of water availability here was the highest in the Amudaraya river basin (see Section 1), but land reclamation conditions and not enough high level of agricultural technique influenced on the reduction of yields of cotton in Khatlon oblast (upstream the Amudarya river basin).

Thus, the achievement of the majority of the participants of the Competition was practical demonstration of sustainable results on the background of less water availability in comparison with the conditions of vegetative period of 1999.

For more objective assessment of the results of the Competition the economic evaluation of agricultural production was carried out on the basis of the data of the participants of the Competition self-monitoring.

3.5. Gross Product

Gross product is the whole plant growing output from the irrigated area in monetary terms.

The **Table 3.5** shows the results of calculations for specific economic indices [*]*), figured for 1 ha of net irrigated area for various oblasts and categories of the participants of the Competition.

Gross product was obtained in the amounts of from 270 $/ha to 722 $/ha. Its value depends upon yield, purchase price and types of produce. The considerable share in the gross product belongs to the production of main crops: cotton, wheat, rice.

In Kazakhstan the main share of gross product belongs to rice - 80-90 % (Kzylorda oblast) and cotton – 82-99 % (South-Kazakhstan oblast).

In the other republics the main share of gross product belongs to cotton, making the following percentage of the total gross output:

- 30-65 % (Kyrgyzstan),
- 60-93 % (Tadjikistan)
- 65-75 % (Uzbekistan).

Fig.3-6 Gross output allocation
(Khatlon oblast - kolkhozes, cooperatives)

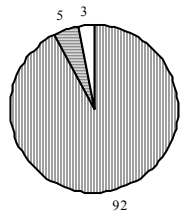
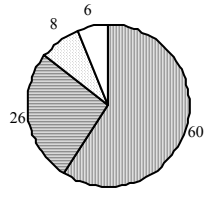


Fig3-7. Gross output allocation
(Khatlon oblast - farms)



Cereal crops (winter wheat) is the second, according their significance, production. Other crops make insignificant contribution to the gross product.

In Tadjikistan production of cereals, first of all – winter wheat, had increased in private farms, compared with the state farms (**fig. 3.6 – 3.9**).

In Kyrgyzstan the share of wheat in the gross product is higher in agricultural co-operatives. In private farms growth of gross product was achieved by growing wide range of crops: cotton, winter wheat, maize for grain, vegetables, melons, tobacco and sunflower (**fig. 3.8, 3.9**).

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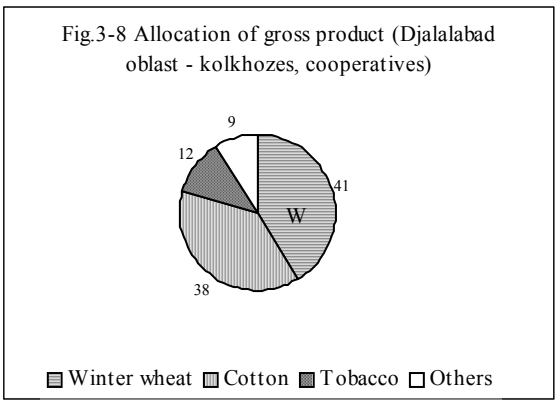
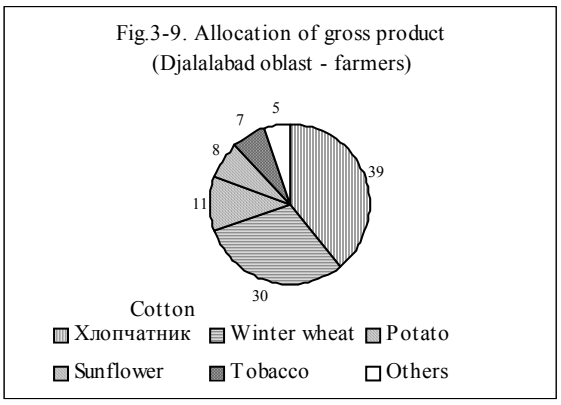
[*]) (Direct) costs, output and gross benefit, and calculated on that basis gross benefit, were assessed. In order to compare the results, all indices were recalculated in USD in accordance with the following exchange rates (average rates for 2000):

- Kazakhstan – 141,833 tenge/1 $
- Kirgizstan – 47,677 som/1 $
- Tadjikistan – 1,87 somoni/1 $
- Uzbekistan – 231,389 sum/1 $
-

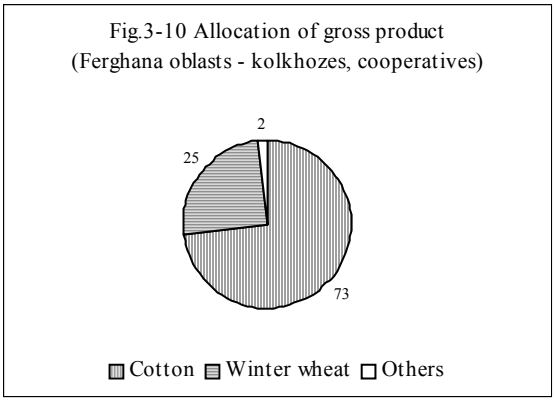
Table 3.5. Analysis of the main agricultural production indices

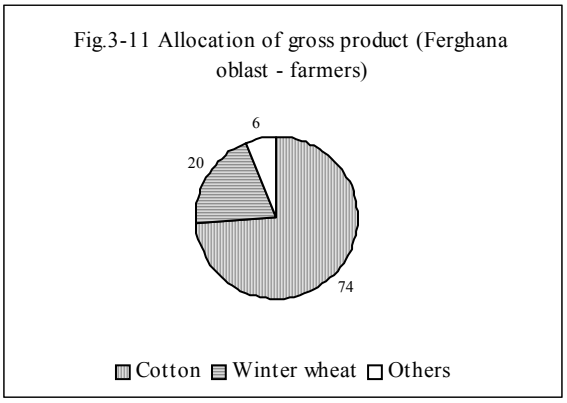
Water Users Associations				
Oblast	Net irrigated area, ha	Costs $/ha	Gross product $/ha	Gross benefit $/ha
Kzylorda				
South Kazakhstan				
Osh	6369	137.0	634.7	497.7
Djelalabad	5074	181.9	695.8	513.9
Sogdy				
Khatlon				
Fergana				
Kashkadarya				
Kolkhozes, associations, cooperatives				
Oblast	Net irrigated area, ha	Costs $/ha	Gross product $/ha	Gross benefit $/ha
Kzylorda	20722	147.2	342.5	195.4
South Kazakhstan	8819	126.2	402.0	275.9
Osh	211	144.6	636.1	491.5
Djelalabad	1605	135.7	458.5	322.8
Sugd	13025	308.4	384.9	76.5
Khatlon	23384	219.1	669.4	450.3
Fergana	17667	387.5	439.9	52.4
Kashkadarya	18089	323.1	383.0	59.9
Private farms				
Oblast	Net irrigated area, ha	Costs $/ha	Gross product $/ha	Gross benefit $/ha
Kzylorda	3877	128.8	269.7	140.9
South Kazakhstan	167	104.1	537.9	433.8
Osh	69	178.8	722.0	543.2
Djelalabad	158	169.4	616.4	447.0
Sogdy	637	512.2	686.4	174.2
Khatlon	133	248.0	498.8	250.7
Fergana	530	526.8	639.9	113.1
Kashkadarya	227	158.3	343.3	185.0





In Uzbekistan the gross product structure of main crops is the same for state, cooperative and private farms.





3.6. Cost of agricultural production

While analyzing the production of agricultural crops, costs, made during their growth had been taken into account. According western methodology for the calculation of benefit by crop types, the concept of variable costs, i.e. costs, directly related to a certain crop, had been applied. Direct costs do not include general productive and economic fixed costs, taxes etc., and therefore only direct costs determine the benefit according crops. This methodology was used in WUFMAS Project for costs estimation. Under the conditions of A-2 self-monitoring, general accounting reports of farms were used as data source [*].

In general, average costs per 1 ha of irrigated land for all farms – participants of the Competition, vary from 104 $/ha to 387 $/ha. Costs above 500 $/ha were recorded for farms in Sogdy oblast of Tadjikistan and Fergana oblast of Uzbekistan. High average costs in Tadjik farms were caused by

[*] In accordance with the generally accepted accounting system, direct costs are split according crops, but unlike the variable costs in the western methodology, include a certain constituent of the fixed costs, and therefore, strictly speaking, the benefit, calculated on the basis of these data can not be considered as marginal.

too high direct costs of cotton growing in the following farms: “Gaforien” farm - 1231 $/ha for cotton growing; “Gafurova” and “Samonien” farms - 1656 $/ha and 1045 $/ha correspondingly for wheat growing.

In Fergana oblast high level of costs was detected for all farms. High cost level related to the agricultural production was also detected in Fergana oblast in 1999, which, despite of the high yield, conditioned the decrease of gross benefit.

Fig.3-12 Analysis of costs (kolkhozes, cooperatives)

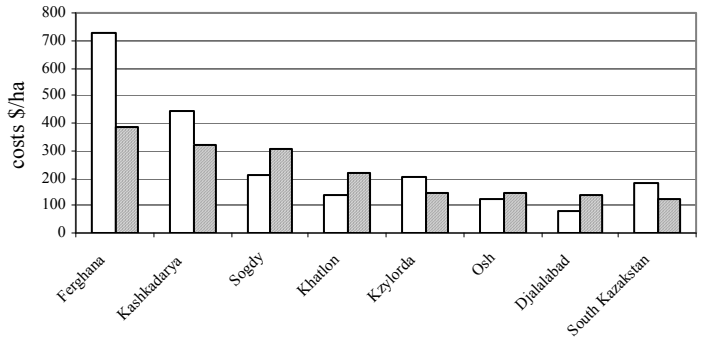
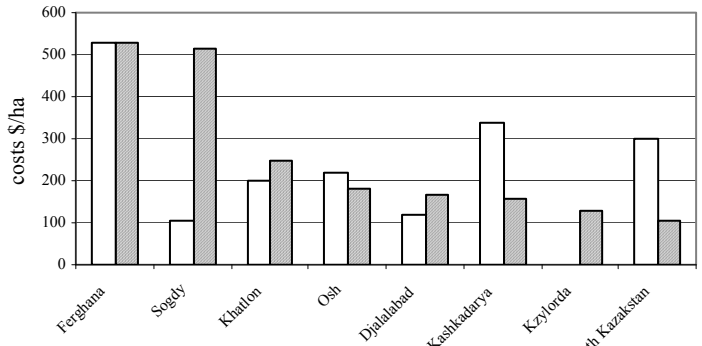


Fig. 3-13 Analysis of costs (farmers)



The comparison of economic results in 1999 and 2000 showed, that in 2000 total costs for agricultural production had decreased in Kazakhstan and Uzbekistan, and increased in Kyrgyzstan and Tadjikistan.

Analysis of indices for oblasts and farms shows reduction of cost factors for kolkhozes and cooperatives – for 60$/ha, for private farms – for 200 $/ha. It reflects the general tendency in the use of resources. In Kashkadarya oblast (Uzbekistan) average cost factors were reduced for 152 $’ha in average for all categories of farms - participants; In Fergana oblast the cost factors are still reported at the high level. In Kyrgyzstan the cost factors were reduced only in the farms of Osh oblast. The considerable growth of average cost factors in the farms of Sogdy oblast could be explained only by the errors in the submitted data.

Average cost factors while growing certain types of crops vary within a wide range:

- cotton - from 100 $/ha to 800 $/ha;
- winter wheat – from 10 $/ha to 450 $/ha;
- lucerne - from 5 $/ha to 300 $/ha;
- rice – from 100 $/ra to 300 $/ra.

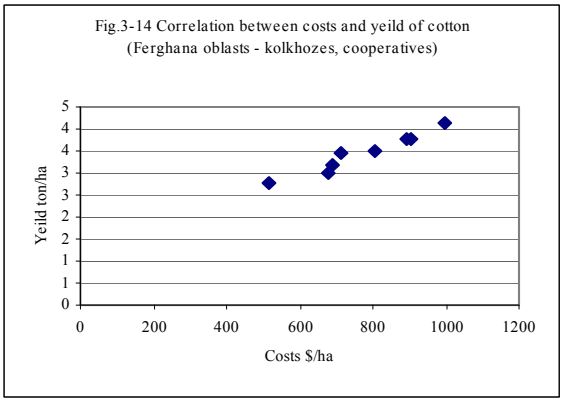


Fig.3-14 Correlation between costs and yeild of cotton (Ferghana oblasts - kolkhozes, cooperatives)

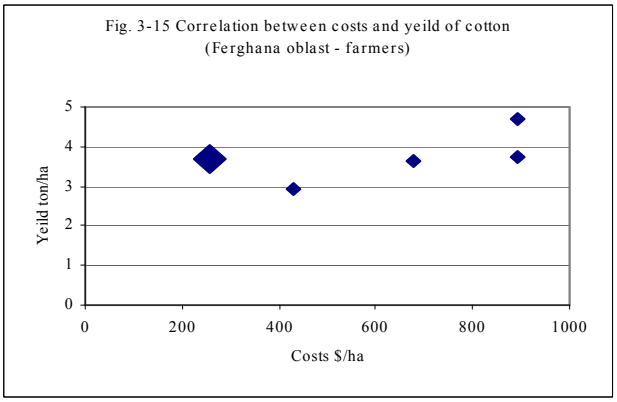


Fig. 3-15 Correlation between costs and yeild of cotton (Ferghana oblast - farmers)

Cost factors are not always coordinated with the value of obtained yield. Costs could be estimated from the relationship between the production output and gross benefit. Costs could be considered as expedient ones, if they resulted in the increase of production output and efficiency of agricultural production. For instance, the increase of costs in Fergana oblast (Uzbekistan) is justified from the view point of yield increase (fig**. 3.14, 3.15**), however, the analysis of return for costs shows, that effectiveness of production is still low, and makes 0,2-0,3 $/$.

Relatively high return for costs was achieved only in “Yangi Khayot” farm, where the costs for

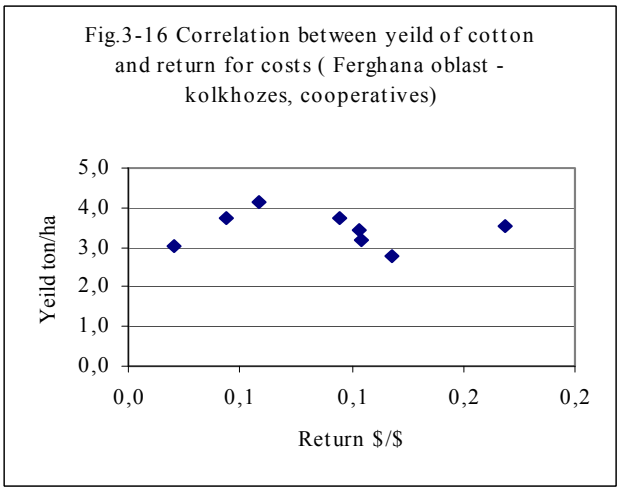


Fig.3-16 Correlation between yeild of cotton and return for costs (Ferghana oblast - kolkhozes, cooperatives)

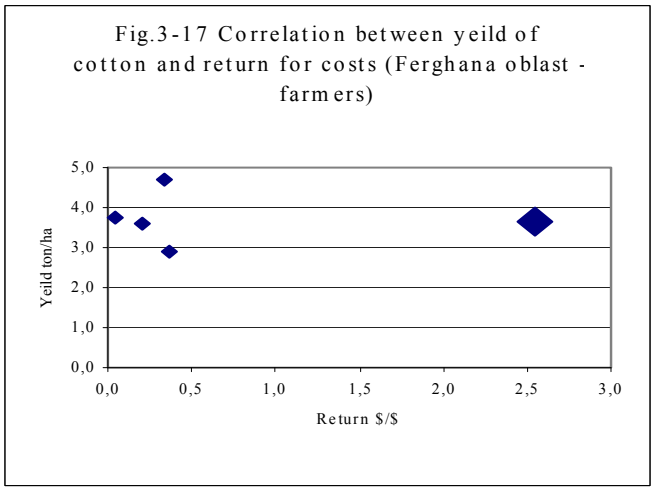


Fig.3-17 Correlation between yeild of cotton and return for costs (Ferghana oblast - farmers)

growing cotton were 258 $/ha – 2.8 times lower, than average index for Fergana oblast (Uzbekistan) – 710 $/ha. Thereafter, return for invested funds had grown in this farm compared with the others (**fig. 3.16, 3.17**) and was 2,5 $/$.

The same situation is with growing winter wheat : economically justified costs corresponded to the yield of 4-4,5 t/ha, and with that the return was 0,6 $/$. Increase of costs sharply reduced the return down to 0,05 $/$.

These results show, that in this case the effectiveness of the production of cotton is determined by the reduction of total direct costs, and ones more demonstrate that in order to increase irrigation efficiency it is necessary, on one hand, to increase the crop productivity, and on the other hand, to reduce and optimize the resources input.