Scientific-Information Center
of Interstate Water Coordination
Commission of Central Asia
(SIC ICWC)

International Water Management Institute
(IWMI)

WAYS OF WATER CONSERVATION

RESULTS OF WUFMAS SUB-PROJECT, WARMAP-2 PROJECT (TACIS) AND SUB-COMPONENT A-2 OF GEF PROJECT "WATER RESOURCES AND ENVIRONMENT MANAGEMENT IN THE ARAL SEA BASIN"

Tashkent - 2002

Two sub-projects results are presented in this collection:

- WUFMAS (Water Use and Agricultural Production Management) have being executed in 1996-1999 within the TACIS program;

- A-2 (Participation in Water Conservation) has being executed in 1999-2000 within GEF Project (Water Resources and Environment Management in the Aral Sea Basin), the World Bank.

Most of presented materials are devoted to water conservation issue at the most sensitive on-farm level.

In the first part major monitoring assessments, executed by WUFMAS group to obtain current situation “photos” and practically realize recommended methods of effectiveness increase in irrigation water use on demonstrative fields. It is showed, that irrigation water use productivity and crop yield increase can be achieved only by integrated approach to water conservation.

Second part of collection is dedicated to review of results of the competition “Water Conservation” second stage conducted in 1999-2000 in eight oblasts of the Aral Sea basin. This competition is important because it helps to reveal traditional methods of water conservation and water users’ initiatives, which do not require substantial investments and can be recommended for wide propagation in irrigated areas of the Aral Sea basin.

Publication is of interest to top and middle level water and agricultural managers, leaders of new form of self-governance – WUAs, trainees, etc.

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INTRODUCTION

Main question of the Aral Sea basin future survival as a whole is the question: can the region refuse from unproductive water resources use and move to strict regime of water conservation. For long time even such large-scale possibility, though already in Soviet time it was proved on example of irrigated massifs of Central Asia, that irrigation systems with gross specific discharge 7.5-9.0 th.m^3 /ha can exist even on lands subjected to salinization (Hunger Steppe, Dukhovny, 1974, 1983).

Presently, the Aral Sea basin consumes more than 2500m^3 water per capita annually with variation within 1800-4000 m^3. Egypt, being in almost the same conditions and well-being level (GNP is about 1000$US per capita), spends only 1200 m^3 per capita, Jordan - 280 m^3, other countries consumes even less.

In order strict water conservation and fight with unproductive water losses are being understood by water users, it is necessary, firstly, to prove it to leaders of agricultural and water organizations and farmers: first should be convinced by interest and practically and the second- only practically.

Two programs described below were dedicated just to this issue. I had opportunity to participate in preparation and implementation of these two programs and I can say, that these programs have laid a solid foundation for this understanding and practical demonstration of water conservation possibilities.

WUFMAS program within EU WARMAP firstly was only analytical one-task was to study all factors of water and land use on background of existing conditions and farms in different parts of the Aral sea basin in order to work out recommendations on irrigated lands productivity improvement.

Since 1998 necessity to continue this program with practical demonstration of water conservation possibilities and water productivity improvement, based on assessments done during 1996-1997, was proved to foreign experts (A. di Carlo, D. Rothwell, M. Armitage). Activity was continued in 9 farms of the region, that allowed demonstration of benefits from water productivity improvement and unproductive water losses reduction to farmers and workshops participants (more than 300 persons).

Production experiments within WUFMAS program served as a base for water conservation competition among water users and water organizations within Component A-2 of the GEF project “Water resources and environment management in the Aral sea basin”. Important role in this program promotion belongs to EC IFAS Chairman Mr. R. Giniyatullin.

Two phases of this program gave good results: real water saving in amount of 1cu.km has been obtained, using traditional methods, without additional investments due to unproductive water losses reduction. Presently, unfortunately, due to the World Bank certain attitude component A-2 was stopped.

Thank to IWMI and personally Mr. F. Rijsberman and Mrs. V. Horinkova support of it became possible to follow up with this program transforming advanced water users experience into demonstrative objects.

We hope this work will be useful both for those participating in the program and all who wants to save water.

Prof. V. Dukhovny,
SIC ICWC Director

PART I

M.G. Khorst

WUFMAS (TACIS) PROGRAM SOLUTIONS FOR IRRIGATION EFFICIENCY IMPROVEMENT

WUFMAS PROGRAM-STUDY OF WATER USE AND AGRICULTURAL PRODUCTION MANAGEMENT

What is WUFMAS

WUFMAS is study of water use and agricultural production conducted in 1996-1999 in Central Asia under support of European Community. Main goal of the first stage of work was study and assessment of real available water resources use and what is its productivity in various natural-climatic zones. In other words, a goal was to obtain "photo" of current situation at on-farm level, which is the least studied.

Official statistics data are limited in their content. Besides, such factors as real irrigation water and other resources use efficiency are evaluated by official statistics only indirectly. Such works were conducted over area of 110 th. ha from total 7.5 mln. ha during the first phase (01.04.1996-31.03.1997) firstly in such scale (18 paired farms-360 fields). Irrigated agriculture has being monitored during three agricultural years according to single methodology.

Major principles for farm selection were based on soil-climatic and reclamation conditions. Each from selected pair of farms characterized certain soil-reclamation zone in the Aral Sea basin. Since 01.04.1997 till 31.03.1998 work was conducted over 80 th. ha according to financing **(Table 1.1).** From total amount of 24 farms (240 fields) 14 were located in SyrDarya and 10 in AmuDarya basin. In each selected farm 10 fields typical in cropping pattern were chosen.

In order to analyze and assess irrigated agriculture under study, all information has been systematized in a database. It is based on reported data from representative farms of the Aral Sea basin at **"on-farm"** level and on actual data at **"field"** level. Monthly information encompasses period since 01.04.1996 till 30.11.1998 (first stage) and since 01.10.1999 till 30.11.1999 (second stage).

Database permits to follow major tendencies in irrigated agriculture for the “farm” and “field” level under internal and external factors and to evaluate separate factors and their multifold influence on water use and agricultural production effectiveness.

Information archive within WUFMAS database contains the following sections:

- Identification of WUFMAS control field location
- Land use
- Water use
- Ground water regime
- Drainage
- Agricultural production factors
- Phenology
- Pests and diseases, weeds
- Agricultural production
- Climatologic
- Soil and water physical and chemical properties
- References:
    - prices
    - costs
    - special information
    - information about foreign currencies rate.

WUFMAS database, representing usually absent in big scale statistical study complex of knowledge for “field” level, is of high importance for:

- Assessment of land and water actual and potential productivity;
- Revealing reserves of water conservation;
- Establishing single methodological base of water consumption assessment and regulation;
- Choice of alternative ways of irrigated lands economic effectiveness improvement, particularly under transition to the market.

WUFMAS contains assessments of:

Land use

- Reported data by the beginning of growing season of each year (April 1) characterizing land use within the farm contour.
- Reported data by the beginning of growing season of each year (April 1) characterizing cropping pattern and planned agricultural product distribution within the farm contour for:
    - irrigated agricultural crops
    - non-irrigated agricultural crops.

Water use

- Monthly data of field measurements characterizing actual water supply to irrigated fields during:
  - leaching irrigations
  - recharge irrigations
  - vegetation irrigations of agricultural crops.
- Reported data by the beginning of growing season of each year (April 1) characterizing planned water use within the farm contour;
- Reported data on decade of each month characterizing water supply for irrigation to farm contour:
  - from main and inter-farm canals
  - from in-contour wells of vertical drainage
  - from open collector-drainage network
  - area irrigated from all sources.

Ground water regime

- Current field measurement data in the beginning and the end of each month, ground water table (if its depth is less than 3m from ground surface) over control fields.

Drainage

- Reported data by the beginning of growing season of each year (April 1) characterizing drainage system operation within the farm contour.
  - vertical drainage
  - subsurface drainage
  -open horizontal drainage

Agricultural production factors

Current field measurement data characterizing physical and money expenses in agricultural production on control fields for the following factors:

- Seeds (seedlings) of agricultural crops
- Fertilizers;
  - organic
  - non-organic
- Agro-chemicals
- Means of plant biological protection
- Machinery
- Hand labor
- Managerial labor.

Phenology

- Current field measurement data at the beginning and the end of each month of growing period characterizing crop growth and development on control fields:
  - average plant height
  - average root depth
  - average flower number (spikes, spedixes, fruits) on one plant
  - average number of cotton open bolls
  - average number of cotton closed bolls
- Current field measurement data for March, June and October of each year on number of plants per 1 m or 1 sq. m, characterizing plant density on control fields.

Agricultural product

- Current field measurement data on agricultural product from control fields:
  - from experimental plots (5 on each field)
  - from control fields.

Pests and diseases, weeds

- Current field measurement data for March, June and October of each year on number of weeds per 1m or 1sq.m, characterizing weed density on control fields.
- Current assessment in March, June and October of each year of damage to agricultural crops (according to 4-score scale) due to weeds density on control fields.
- Name of agricultural pests or diseases and date of the first their appearance on control fields.
- Identification of agricultural crop pests or diseases on control fields.
- Assessment of damage to agricultural crops (according to 4-score scale) due to pests or diseases and methods of their fighting on control fields.

Meteorological elements

- Current information about daily (during growing season) measurements of evaporation from water surface intensity by pan class A (installed in each farm).
- Current information about meteorological elements mean-monthly values based on the nearest weather station data.
- Mean-multiyear data characterizing mean-monthly values of meteorological elements from the nearest weather station.

Soil and water physical and chemical properties

- Laboratorial data on soil water-physical properties from control fields.
- Field data from penetrometers (compactness-meter) over soil horizons of control fields (measurements of spring 1997).
- Laboratorial data on soil chemical properties from control fields (spring-autumn).
- Field measurement data on irrigation water infiltration rate over typical control fields (summer 1996).
- Laboratorial data on soil nutrient elements from control fields (spring-autumn).

- Laboratorial data on water physical and chemical properties from control fields and its quality assessment:
  - irrigation (spring-autumn)
  - drainage (spring-summer-autumn)
  - ground (spring-summer-autumn).

RESULTS OF ASSESSMENT

Irrigation water use productivity according to WUFMAS data

Along with irrigation system elements efficiency, irrigation water use effectiveness in irrigated agriculture is assessed by irrigation water specific expenses per unit production and "payment" for unit of irrigation water spent by crop yield.

Within the framework of the WUFMAS project such assessment, over average-weighted indicators, is being conducted for major crops of the region based on measurements on control fields **(Table 1.1).**
Cotton fields are most representative for such assessments. Average size of control field is 8ha. Gross water supply at inlet level immediately to the fields, including recharge irrigations, often combined with leaching and vegetation irrigations, is taken in irrigation water expenses.

Average "gross-field" water supply over control cotton fields amounted for 7243 m^3/ha, including 2039 m^3/ha for leaching and recharge and 5204 m^3/ha for vegetation irrigations. Thus, under average cotton yield 2.33 t/ha irrigation water expenses per yield unit amounted for 311 m^3/ha, when water productivity at field level equaled to 0.32 m^3/ha. Profit per water spent unit was 0.06 \$/m^2.

Irrigation water highest expenses at field level and low "payment" by yield is found in Tajikistan (control fields of Leninabad oblast) - 8250 m^3/t and 0.12 kg/m^3, respectfully. Profit per water unit was 0.05 \$/m^3.

Lowest water expenses and high "payment" by yield is achieved in Kazakhstan: 1600 m^3/t and 0.43 kg/m^3, respectfully. Profit per water spent unit was 0.17\$/m^3.

Similar assessment made for winter wheat (47 fields with average area 11 ha in 17 farms of the region) showed the following: average-weighted irrigation norm "gross-field" amounted for 4575 m^3 /ha. Under average yield over region 2.23 t/ha, irrigation water expenses were 2080 m^3 /t and water productivity at field level 0.49 kg/m^3, losses amounted for 0.008 \$/m^3.

Highest water expenses per irrigation water spent unit and lowest "payment" by yield are found in Turkmenistan: 4380 m^3/t and 0.23 kg/m^3, respectfully.

Highest losses per unit water spent are found in Uzbekistan (0.03 \$/m^3).

TABLE 1.1.

Assessment of major crops irrigation productivity according to data from WUFMAS control fields (01.10.96-30.09.97)

A) COTTON

Indicators (average weighted assessment)		Unit	Kazakhstan (2 farms)	Kyrgyzstan (2 farms	Tajikistan (2 farms)	Turkmenistan (2 farms)	Uzbekistan (9 farms)	Region (17 farms)
Number of control fields		field	13	13	10	9	52	97
Irrigation norm “gross-field”		m^3/ha	5750	9274	14198	7956	5339	7243
including	Leaching +recharge	m^3/ha	4573	0	0	1977	1999	2039
	(number of irrigations)	(irrigation)	(1)	(0)	(0)	(1)	(1,4)	(0,9)
	Vegetation irrigations	m^3/ha	1177	9274	14198	5979	3340	5204
	(number of irrigations)	(irrigation)	(1,2)	(5,2)	(6,2)	(4,2)	(3,2)	(3,5)
Average level during vegetation		m	2,4	>10	6.6	1.8	2.1	3.5
Yield		c/ha	25.0	24.1	17.2	27.5	23.2	23.3
Irrigation water expenses per production unit		m^3/c	230.5	385.5	824.5	289.2	230.6	310.9
Irrigation water productivity		kg/m^3	0.43	0.26	0.12	0.34	0.43	0.32
		\$/m^3	0.22	0.14	0.08	0.10	0.12	0.12
Irrigated land productivity		\$/ha	1291,4	1314,0	1192,2	760,5	652,7	860,9
Profit		\$/ha	982,2	759,9	719,2	483,0	250,7	466,8
		\$/m^3	0.17	0.08	0.05	0.06	0.05	0.06

B) WINTER WHEAT

Indicators (average weighted assessment)	Unit	Kazakhstan (2 farms)	Kyrgyzstan (2 farms	Tajikistan (2 farms)	Turkmenistan (2 farms)	Uzbekistan (9 farms)	Region (17 farms)
Number of control fields	field	2	8	6	8	24	48
Irrigation norm “gross-field”	m^3/ha	978	4368	7047	7637	3727	4575
(number of irrigations)	(irrigation)	2,0	2,1	4,1	4,6	4,3	3,8
Average level during vegetation	m	1,6	>10	8,8	2,0	1,7	4,0
Yield	c/ha	8,8	29,1	21,3	17,4	23,1	22,3
Irrigation water expenses per production unit	m^3/c	110,6	150,0	331,3	438,9	161,1	207,8
Irrigation water productivity	кg/m^3	0,90	0,67	0,30	0,23	0,62	0,49
	\$/m^3	0.29	0.10	0.04	0.02	0.09	0.07
Irrigated land productivity	\$/ha	279,4	454,3	263,7	141,8	350,6	324,7
Profit	\$/ha	85,2	148,3	34,9	-42,1	-109,0	-37,0
	\$/m^3	0.09	0.03	0.005	-0.006	-0.03	-0.008

C) RICE

Indicators (average weighted assessment)	Unit	Kazakhstan (2 farms)	Uzbekistan (3 farms)	Region (5 farms)	Indicators (average weighted assessment)	Unit	Kazakhstan (2 farms)	Uzbekistan (3 farms)	Region (5 farms)
Number of control fields	field	14	9	23	Irrigation water productivity	кг/$м^3$	0.19	0.16	0.18
Irrigation norm “gross-field”	m^3/ha	17747	26103	19327		\$/$м^3$	0.038	0.038	0.038
Average level during vegetation	m	0,44	0,68	0,49	Irrigation water productivity	\$/га	674.9	1004.7	828.4
Yield	c/ha	33,2	41,9	34,9	Profit	\$/га	207.2	375.0	285.4
Irrigation water expenses per production unit	m^3/c	534.1	622.7	554.3		\$/$м^3$	0.012	0.014	0.014

Least water expenses and high "payment" by yield is revealed in Kazakhstan – 110 m^3 /t and 0.90 kg/m^3. Profit per water spent unit is 0.09 \$/m^3. Price policy in agriculture conducted in the Central Asian countries impacts significantly productivity assessment.

Land use productivity and assessment of influencing factors [1]

Land productivity is determined by final product of agricultural production. Agricultural product depends on range of factors, which can be separated into natural-climatic and organizational-productive. Low natural fertility of zonal soils should be supported by permanent application of nutrient elements.

Situation with inputs in WUFMAS farms reflects picture of the region as a whole. From necessary elements mostly nitrogen is applied. Share of nitrogen-based fertilizers was 80-100% from total amount of fertilizers, especially in Kazakhstan and Turkmenistan.
Phosphorus was applied together with compounds like ammophos, phosphate during growing period; super-phosphate application in autumn before plowing, foreseen by technology, is not executed.

Potassium fertilizers were scarce and not applied because of their deficit, though only 48% of control fields can be considered as fully provided with potassium. Lack of fertilizers led to mobile phosphorus and potassium content in soil reduction on 65 and 50%, respectfully.

Land salinization (from total area of control fields-strongly saline: 13% in Kazakhstan, 9% in Uzbekistan, 2% in Turkmenistan and Tajikistan and out of operation drainage (46% of subsurface and 36% of open) create unfavorable reclamation conditions. Tendency of soil salinization growth is observed. According to soil abstract electric conductivity measurements, average salinity value grew on 51% for two years[2].

Critical situation is created in plant protection system. In spite of many new chemicals appearance, their application is difficult because of high prices. Insignificant amount of insecticides (mostly for cotton) was applied: herbicides were practically not applied in spite of their application necessity.

For example, fields, astounded by Chloridea cotton moth, were treated in Kazakhstan on 100%, in Kyrgyzstan - 62%, in Uzbekistan - 42%. Machinery (tracks and tractors) is ready for operation only on 75%, combines - on 61%. Imported machinery is used ineffectively. It can be profitable in case of its efficiency increase by 7-8 times.

Gross margin (\$/ha), calculated as difference between income and variable costs of crop production, allows evaluate benefit from specific crop cultivation. Analysis of gross margin allows, that cotton is the most profitable crop.

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[1] *Analyzes and assessments prepared by Dr. G. Stulina, WUFMAS Regional Working Group member*
[2] *Soil chemical and physical analyses were executed in WUFMAS regional laboratory under supervision of Dr. J. Shirokova*

Significant difference in gross margin over republics **(Table 1.2)** is explained by purchase price, which was in Uzbekistan 244 $/t, in Kyrgyzstan - 493 $/t, in Kazakhstan - 426 $/t, in Turkmenistan - 247 $/t, in Tajikistan - 597 $/t of row cotton.

Gross margin on rice was positive for all farms and amounted for 309.5$/ha. Wheat production in Uzbekistan and Turkmenistan (except control farms in Khorezm and Bukhara oblast) is unprofitable.

High gross margin is received by farms in Kazakhstan (cultivating maize and wheat) and Turkmenistan (alfalfa). Analysis of sensibility to yield, purchase price and variable costs changes shows that production of cotton and rice is rather stable. Gross margin remains positive even under variable cost increase by 25-50% and yield and purchase price decrease by 15%.

MAIN OUTCOMES OF IRRIGATION EFFICIENCY ASSESSMENT

Water conservation issue assessed by WUFMAS

Situation in water use of the region is dramatic, because under water supply limitation water deficit is aggravated by irrational water use at on-farm level. Major losses occur at on-farm and field level. Over-normative losses constitute 4436 m^3 /ha or 37% from total water supply to farm contour.

Based on preliminary calculations and direct measurements at field level **(Table 1.2)** water losses amounted for 21% due to on-farm irrigation system technical state. In zones with shallow ground water near half of these losses returns through capillary rise to root zone. This addition somewhat increases general efficiency of irrigation water use but does not match optimal reclamation regime preventing soil salinization and ground water quality aggravation.

Most part of “over-norm” losses (20% of water supply) in Kyrgyzstan and Tajikistan are caused by irrational irrigation technique on lands with steep slopes.

In midstream and downstream most losses occur during water conveyance from farm outlet to the field. These losses are so called organizational losses. They constitute 15-35% of water supply and caused by water registration and management absence at on-farm level. Often (particularly in new developed zones) significant part of water is released without using it for irrigation; at the same time, water deficit occurs during most tense phases of the growing season. It is proved by calculations conducted for various natural-climatic zones with FAO CROPWAT program.

In many downstream and midstream farms crop water requirements are satisfied mostly at expense of capillary rise from ground water.

TABLE 1.2

Estimation of water losses between farm intake, field intake and root zone (for the period from 01.10.1996 till 30.09.1997)

	Zone	Soil type	Duty of water area	Water supply at farm boundary	Conveyance losses from farm to field boundaries						Water supply at farm boundary	Field application losses (fraction of field intake)						Water retained by root zone	TOTAL "EXTRA" LOSSES (1)	
					TOTAL		including «normative»		including «extra» (1)			TOTAL		including «normative»		including «extra» (1)				
				m^3/ha	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha	m^3/ha	%
Kazakhstan																				
01	C-I	A	IX	**29831**	17744	59	8949	30	8794	29	**12087**	5802	48	5802	48	0	0	6285	8794	29 (0)[*]
02	C-I	A	IX	**22357**	13479	60	6707	30	6771	30	**8879**	4262	48	4262	48	0	0	4617	6771	30 (0)
03	Ц-II	Б	V	**6903**	3547	51	1381	20	2167	31	**3356**	470	14	470	14	0	0	2886	2167	31 (0)
04	Ц-II	Б	V	**9559**	6250	65	2390	25	3860	40	**3310**	993	30	463	14	530	16	2317	4390	46 (6)
Average on 4 farms				**17163**	**10255**	**60**	**4857**	**28**	**5398**	**31**	**6908**	**2882**	**42**	**2749**	**40**	**132**	**2**	**4026**	**5530**	**32 (1)**
Kyrgyzstan																				
07	Ц-I	Б	III	**3481**	1256	36	940	27	316	9	**2226**	1447	65	668	30	779	35	779	1095	31 (22)
08	Ц-I	Б	III	**10441**	7374	71	2819	27	4555	44	**3067**	2055	67	920	30	1135	37	1012	5690	54 (11)
09	Ц-II	В	III	**10209**	2079	20	1531	15	548	5	**8129**	4959	61	2601	32	2357	29	3170	2906	28 (11)
10	Ц-II	В	III	**13838**	5715	41	4151	30	1563	11	**8123**	6011	74	2518	31	3493	43	2112	5056	37 (25)
Average on 4 farms				**9492**	**4106**	**43**	**2360**	**25**	**1745**	**18**	**5386**	**3618**	**67**	**1677**	**31**	**1941**	**36**	**1768**	**3687**	**39 (20)**
Tajikistan																				
14	Ц-II	В	II	**17933**	5987	33	5380	30	607	3	**11946**	7526	63	4540	38	2987	25	4420	3594	20 (17)
37	Ц-II	В	II	**17737**	6509	37	5144	29	1365	8	**11228**	7860	70	4267	38	3593	32	3368	4958	28 (20)
Average on 2 farms				**17835**	**6248**	**35**	**5262**	**30**	**986**	**6**	**11587**	**7693**	**67**	**4403**	**38**	**3290**	**29**	**3894**	**4276**	**24 (18)**
Turkmenistan																				
17	Ю-II	A	VIII	**7265**	3124	43	2906	40	218	3	**4141**	2236	54	911	22	1325	32	1905	1543	21 (18)
18	Ю-II	A	V	**7703**	3875	50	1849	24	2026	26	**3828**	1187	31	766	20	421	11	2641	2447	32 (5)
Average on 2 farms				**7484**	**3499**	**47**	**2377**	**32**	**1122**	**15**	**3984**	**1711**	**43**	**838**	**21**	**873**	**22**	**2273**	**1995**	**27 (12)**
Uzbekistan																				
21	Ю-II	A	III	**15293**	9712	64	2753	18	6960	46	**5581**	2232	40	1172	21	1060	19	3349	8020	52 (7)
22	Ю-II	A	V	**14341**	8668	60	2868	20	5800	40	**5673**	1702	30	1021	18	681	12	3971	6480	45 (5)

	Zone	Soil type	Duty of water area	Water supply at farm boundary	Conveyance losses from farm to field boundaries						Water supply at farm boundary	Field application losses (fraction of field intake)						Water retained by root zone	TOTAL "EXTRA" LOSSES (1)	
					TOTAL		including «normative»		including «extra» (1)			TOTAL		including «normative»		including «extra» (1)				
				m^3/ha	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha	m^3/ha	%
23	Ц-II	Б	V	**8024**	5448	68	2006	25	3441	43	**2577**	1082	42	515	20	567	22	1495	4008	50 (7)
24	Ц-II	Б	V	**7246**	5354	74	1522	21	3832	53	**1892**	719	38	378	20	341	18	1173	4173	58 (5)
25	Ц-I	А	VII	**11074**	4289	39	1993	18	2296	21	**6785**	3189	47	1289	19	1900	28	3596	4196	38 (17)
26	Ц-I	А	VII	**18421**	10031	54	3868	21	6162	33	**8390**	4866	58	1846	22	3020	36	3524	9183	50 (16)
27	С-II	А	V	**2761**	1083	39	966	35	117	4	**1678**	84	5	84	5	0	0	1594	117	4 (0)
28	С-II	А	VII	**6752**	2149	32	1688	25	461	7	**4603**	2118	46	2118	46	0	0	2486	461	7 (0)
35	Ц-II	А	V	**12858**	8068	63	3472	27	4597	36	**4789**	1916	40	670	14	1245	26	2874	5842	45 (10)
36	Ц-II	А	V	**12467**	7601	61	3366	27	4235	34	**4866**	2141	44	681	14	1460	30	2725	5694	46 (12)
Average on 10 farms				**10924**	**6240**	**57**	**2450**	**22**	**3790**	**35**	**4683**	**2005**	**43**	**978**	**21**	**1027**	**22**	**2679**	**4817**	**44 (9)**
Average on 22 farms				**12113**	**6334**	**52**	**3120**	**26**	**3213**	**26**	**5780**	**2948**	**51**	**1826**	**30**	**1222**	**21**	**2832**	**4436**	**37 (10)**

Note: (1) "normative" values are theoretical ideal rates for the physicial conditions of the canal or farm as reported by farm staff, but estimated actual losses in excess are termed "extra"

Due to irrational organization efficiency of irrigation water supplied to the field equals 0.5 on average (in 3 republics 0.57-0.58 and 2 republics 0.33-0.34); at the same time, crop water consumption deficit achieves 30-56%.

As a consequence, optimal reclamation regime violation provokes soil salinization and yield reduction.

Assessment of actual effectiveness of vegetation irrigations at field level

Assessment of actual effectiveness of vegetation irrigations at field level is presented in **Table 1.3**.

Common regularity for all fields is low field efficiency during the first vegetation irrigation (2-16%). It is caused by incompliance of high “gross” irrigation norms (140-176 mm) with small layer of moistening (0.30-0.35 m). Irrigation on shallow furrows (10 cm) on background of poor leveling causes very small jets and irrigation duration and running up norm increase. To the end of growing season, efficiency increases because “gross” irrigation norms come in compliance with layer of moistening (60-66%) in farms without slope (farms 23, 1, 36) and 40-53% in farms with steep slopes. Average-weighted efficiency for growing season remains low (21-40%).

For more detail assessment water balance elements are used.

In farms located on **steep** slopes (farms 09, 10) near 50% of water consumption is covered by vegetation irrigations and rest 50% are covered by precipitation and soil moisture storage in equal shares. “Gross” norm exceeds by 2 times water consumption norm. High losses for surface release beyond irrigated field and percolation beyond rooting zone occur.

TABLE 1.3

Comparative assessment of actual irrigation regimes with recommended ones for cotton water consumption potential level based on CROPWAT program

Farm	Field	ACTUAL IRRIGATION REGIMES					OPTIMAL IRRIGATION REGIMES UNDER CROPWAT RECOMMENDATIONS				
		Number of waterings	Date of watering	Irrigation interval [days]	Gross irrigation depth [mm]	Irrigation efficiency [%]	Number of waterings	Date of watering	Irrigation interval [days]	Gross irrigation depth [mm]	Irrigation efficiency [%]
9	4			15					88		70
		1	01.05.97		259	10.4	1	13.07..97		154	
				43					23		
		2	13.06.97		204	9	2	05.08..97		154	
				26					26		
		3	09.07.97		204	30	3	31.08.97		148	
				14					44		
		4	23.07.97		201	33.3					
				15							
		5	07.08.97		173	40					
				68							
10	8			17					88		70
		1	02.05.97		194	16	1	12.07.97		176	
				22					26		
		2	24.05.97		184	0.9	2	07.08.97		172	
				30					32		
		3	23.06.97		189	25.2	3	08.09.97		177	
				12					29		
		4	05.07.97		176	26.5					
				27							
		5	01.08.97		146	53.3					
				67							
17	5			56					69		70
		1	06.06.97		204	8.7	1	19.06.97		140	
				27					17		
		2	03.07.97		131	63.6	2	06.07.97		143	
				30					19		
		3	02.08.97		139	63	3	25.07.97		145	
				21					19		
		4	23.08.97		143	30.3	4	13.08.97		143	
				54					21		
							5	03.09.97		142	
									43		
23	7			15					77		70
		1	05.05.97		157	1.8	1	06.07.97		160	
				53					24		
		2	27.06.97		170	20.5	2	30.07.97		162	
				10					26		
		3	07.07.97		83	60.6	3	25.08.97		159	
				87					38		
36	8			63					70		70
		1	18.06.97		156	6.6	1	25.06.97		148	
				29					17		
		2	17.07.97		156	49.2	2	12.07.97		157	
				24					17		
		3	10.08.97		139	65.6	3	29.07.97		148	
				72					18		
							4	16.08.97		156	
									21		
							5	06.09.97		150	
									45		

TABLE 1.4

Rooting zone water balance (according to FAO CROPWAT)

Farm Field	Cotton water consumption during vegetation (acc/ to CROPWAT)		Physical indicators					Optimized indicators under efficiency 70%				
			Water supply "gross field"	Elements of rooting zone's water balance				Water supply "gross field"	Elements of rooting zone's water balance			
	For maximum yield	Actual		Water accumulated during irrigation	Effective rainfall	Groundwater contribution	Soil moisture used supplies		Water accumulated during irrigation	Effective rainfall	Groundwater contribution	Soil moisture used supplies
	PWU	AWU	$Grlr_{(Cr)}$	$Ir_{(Cr)}$	P_{eff}	Ge	Δ W	$Grlr_{(Cr)}$	$Ir_{(Cr)}$	P_{eff}	Ge	Δ W
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
09.04	528	493	1042	254	122	0	117	455	319	122	0	87
10.08	537	531	889	275	126	0	130	525	367	126	0	44
17.05	854	843	617	242	73	420	108	712	499	73	165	117
23.02	620	407	410	88	110	184	25	481	337	110	96	77
36.08	878	762	450	178	82	367	135	759	532	82	164	100
AVERAGE	**683**	**607**	**682**	**207**	**103**	**194**	**103**	**586**	**411**	**103**	**85**	**85**

In farms located on irrigated lands **without** slope (farms 17, 36) cotton water consumption mostly is covered by ground water capillary rise (average ground water table during growing season is 1.7 m). Ground water is formed at expense of percolation in contrary furrows as well as filtration losses from irrigation canals and inflow from adjacent irrigated fields.

In farms located on lands with **low** slope gradients (farm 23) cotton water consumption mostly is also covered by ground water capillary rise (average ground water table during growing season is 2.2 m). Low efficiency on background of perfect irrigation network (flumes) and drainage (subsurface) is caused by absence of coordination in cotton irrigation schedule.

Option of optimal irrigation schedule

What optimal scenario for irrigation schedule can be recommended for farms considered (under known climatic factors of 1997 and water-physical soil properties) and what preconditions should be provided for that?

Let us take an option under which successive irrigation date and norm are appointed under easy available moisture exhaustion in rooting zone (60-65% of available soil moisture).

Normally operating drainage in zones of **small** gradients and **without** slope should provide ground water level position at depth of 2.5 m. On the other hand, deep plowing, soil compactness elimination can allow rooting zone increase up to 1 m.

For zones with **high** slope gradients it is necessary, first of all, to provide field efficiency about 70%. It can be achieved by using scheme of tier-irrigation. According to this scheme field is divided into 3-4 tiers. Shokh-ditch is created in a center of irrigated plot. Irrigation is started from the first tier over short (60-70 m) furrows. After running up of jets to the end of 2nd tier furrow, release complements supply from shokh-ditch. Irrigation of other tiers is performed in the same succession. Tier-irrigation permits to achieve regular moistening of irrigated plot and substantially reduces surface release because release will be done only from furrows of last tier.

For zones **without** slope field efficiency increase can be provided by irrigation on contrary furrows (under satisfactory regularity of moistening), but furrow depth should be not less than 20-25 cm, e.g. furrow should have necessary accumulative capacity to provide excessive water suction after irrigation. Under this condition big jets (q = 0.7-1.5 l/s) application and irrigation duration reduction is possible, that allows create regular moistening background. Cotton sowing is desirable on preliminary prepared ridges that provides even shoots.

For zones with **small** slope gradients field efficiency increase can be provided by irrigation in short (100-150 m) blind furrows under their depth of 20-25 cm.

Taking mentioned above preconditions and supposing soil moisture formed by precipitation and recharge irrigation equaled to 90% of easy available moisture, optimal irrigation schedules are calculated for maximal yield according to CROPWAT program **(Table 1.3).**

First vegetation irrigations are started in phase of flowering and conducted with interval 23-32 days in zone of **high** slope and 17-26 days in zones of **small** slope and **without** one, that permits to stimulate root growth during first stages of plant development.

In zone of **high** slope (farm 09, 10) number of vegetation irrigations is reduced down to three and irrigation norm does not exceed 155-177 mm.

Regularity of optimized irrigation norm for each farm make water supply management more simple. Ratio between cotton water consumption “coverage” elements **(Table 1.4)** change to increase of usefully used moisture, accumulated during irrigations, within rooting zone from 1.3 (farm 09, 10) to 3.8 times (farm 23) and capillary rise contribution reduction by 2-2.5 times (farm 17, 23, 36).

Assessment of water supply “deficit-excess”

Comparison of rooting zone balance under actual and optimized indicators is presented in **Table 1.5**. Assessment of water supply “deficit-excess” by **maximal** yield level shows:

- Under actual field efficiency water supply deficit during growing season varies within 6mm (farm 10) and 213 mm (farm 23).
- Under optimized elements of water balance and optimal field efficiency (70%) saved water volume (compared with water supply of 1997) is within 364 mm (farm

10) and 587 mm (farm 09). In the rest of farms water consumption deficit is 71 mm (farm 23) - 309 mm (farm 36).

TABLE 1.5

Assessment of water supply "deficit-excess" for cotton growing season

Farm. Field	Cotton yield		Average-weighted field efficiency	«Deficit(-) - Excess(+)» water supply under maximum yield	
	Actual	Maximum acc. CROP-WAT under given conditions		Under actual field efficiency	Under field efficiency = 70 % and ground water table more than 2,5 м
	[c/ha]	[c/ha]	[%]	[мм]	[мм]
09.04	26,5	30	24	-35	587
10.08	24,4	30	31	-6	364
17.05	36,2	37	39	-11	-95
23.02	19,0	30	21	-213	-71
36.08	32,1	36	40	-116	-309
Average	**27,6**	**33,5**	**31**	**-76**	**95**

Analysis fulfilled by WUFMAS, based on results of growing season, showed, that water consumption deficit at field level mostly is provoked by high organizational losses between outlets to farm and the field. Average for the region these losses (over-losses caused by irrigation network technical state) constitutes 37% from water supply to farm contour. Thus, under proper organization of on-farm water use, irrigation without deficit can be provided. It is achieved by irrigator's command lands cumulative irrigations and water rotation between irrigators and on-farm canals as well as technological irrigation schemes on background of improved agro-technique.

Results of WUFMAS recommendations application

During growing season of 1999, practical realization of recommendations on irrigation water productivity increase in 9 farms has been started.

Preliminary, technical-economic assessments of 7 various scenarios were made and one scenario has been chosen foreseeing irrigation water expenses reduction with simultaneous yield increase due to improved agro-technique. Special attention was paid to pre-sowing soil preparation and irrigation technique optimization during growing season. Besides, plant protection has been properly organized. Irrigation terms and norms were appointed differentially depending on plant development and weather conditions.

Control fields were selected similar for soil-reclamation conditions, but all operations were executed traditionally.

Comparison of results from demonstration and control fields, presented in **Table 1.6**, proves correctness of these recommendations and their practical applicability without significant capital investments, mostly due to management effectiveness improvement.

On 7 demonstration cotton fields, presented in **Table 1.6**, yield increased compared with control fields on 86.5%; water expenses per agricultural production unit reduced on 51.7% and irrigation water productivity increased more than by 2.5 times.

On each demonstration site workshops for farm's staff and leaders of water and agricultural organizations were organized. Workshop participants noted WUFMAS practical significance concerning irrigation effectiveness improvement and water conservation.

TABLE 1.6

Irrigation water expenses and yield (WUFMAS-99)

Farm's code	Yield				Water expenses per square unit		Water expenses per square unit		Water expenses per yield unit			
	Type of field				Type of field		Type of field		Type of field			
	Presentative	Control value	Difference	Yield growth	Presentative	control value	Presentative	Control value	Presentative	Control value	Difference	Costs reduction
	(t/ha)	(t/ha)	(t/ha)	(%)	(th.m3/ha)	(th.m3/ha)	(th.m3/ha)	(th.m3/ha)	(th.m3/t)	(th.m3/t)	(th.m3/t)	(%)
3 Kaz	2,92	1,38	1,54	111,6	3,56	2,99	3,56	2,99	1,22	2,17	0,95	43,8
9 Kirg	2,48	2,21	0,27	12,2	5,98	6,09	5,98	6,09	2,41	2,75	0,34	12,4
14 Taj	3,23	1,87	1,36	72,7	19,93	26,15	19,93	26,15	6,17	13,98	7,81	55,9
18 Tur	3,39	1,07	2,32	216,8	8,05	7,23	8,05	7,23	2,37	6,76	4,39	64,9
22 Uz	4,41	2,28	2,13	93,4	8,12	13,42	8,12	13,42	1,84	5,89	4,05	68,7
34 Uz	4,43	2,73	1,70	62,3	3,35	8,03	3,35	8,03	0,76	2,94	2,18	74,3
35 Uz	4,52	3,32	1,20	36,1	6,57	8,36	6,57	8,36	1,45	2,52	1,06	42,3
Average	**3,63**	**2,12**	**1,50**	**86,5**	**8,40**	**11,22**	**8,40**	**11,22**	**2,32**	**5,29**	**2,97**	**51,7**

Farm's code	Grew production costs		Agricultural production factors costs		Benefit		Water productivity			
	Type of field		Type of field		Type of field		Type of field		Difference	Growth (relative to control value)
	Presentative	Control value	Presentative	Control value	Presentative	Control value	Presentative	Control value		
	($/ha)	($/ha)	($/ha)	($/ha)	($/ha)	($/ha)	($/th.m3)	($/th.m3)	($/th.m3)	(%)
3 Kaz	657	306	384	233	273	73	77	24	52	215
9 Kirg	668	586	580	563	88	23	15	4	11	289
14 Taj	1291	756	517	404	774	352	39	13	25	189
18 Tur	654	203	504	579	150	-376	19	-52	71	136
22 Uz	753	385	594	480	159	-95	20	-7	27	377
34 Uz	1495	869	996	671	499	198	149	25	124	503
35 Uz	1036	763	229	180	807	583	123	70	53	76
Average	**936**	**553**	**543**	**444**	**393**	**108**	**63**	**11**	**52**	**255**

CONCLUSION

Rational water use and water conservation in irrigation could save substantial amount of water. It is proved by water use limitation measures which allowed reduce water supply for irrigation from 13 th.m^3/ha in 1990 to 11.1 th.m^3/ha in 1995.

Major measures in water conservation presently are the following:

- Complex and partial reconstruction (modernization) of irrigation systems;
- Advanced irrigation technique and technology introduction;
- Water rotation and other measures undertaken to combat unproductive water losses in on-farm irrigation network and on the field;
- Creation of the pilot projects system in water conservation demonstrating possibility and economic effectiveness of water saving;
- Strict water consumption limitation, based on plant biological requirements.

Range of simple and cost-effective organizational measures on water conservation could increase water use effectiveness and irrigation productivity, but wide-scale conservation and land fertility improvement is possible only through substantial financial contributions in irrigation infrastructure and technology.

It worth to note, that water conservation technology introduction is made more difficult due to two principal provisions:

- Water conservation measures through irrigation systems reconstruction and modernization require 1.0-1.4$/$m^3$ of saved water;
- Land users are not interested directly in water conservation because most part of water saving effect directed to ecological and social issues solution, in which society as a whole is interested.

Therefore, inter-farm and on-farm irrigation systems efficiency increase, irrigation technique and technology and field leveling improvement, full or partial hydroreclamation systems reconstruction can be solved with assistance of the state at expense of investments increase and soft credits system establishing.

Taking into account role of irrigated agriculture in economy of the region, it is necessary to create state system of water and agricultural sector support aimed at irrigated lands and irrigation water productivity improvement.

For this purpose is expedient to establish strict complex of prior water conservation measures and work out programs of concrete actions for the nearest and remote future.

Possible set of water conservation technologies is presently limited by lack of financing and resources. Under these conditions the most important is choice of priorities.

Prior objects of water conservation technology application are the following:

- Irrigation systems with permanent low water availability;

- Water lift irrigation systems;
- Irrigation massifs with high soil permeability and complex surface relief;
- Pre-mountain irrigated areas, because excessive water consumption in this area negatively impacts irrigation water quality and environment downstream.

PART II

M.G. Khorst, N.N. Mirzayev, G.V. Stulina

PARTICIPATION IN WATER CONSERVATION: REGIONAL MONITORING OF THE II STAGE OF COMPETITION

(Regional Monitor's Report for 2000
on the GEF project's sub-component A-2)

One hundred sixty seven (142 in 1999) monitoring objects of 4 categories were as follows: 29 (25 in 1999) rayon water organizations, 10 (12 in 1999) water users associations, 57 (47 in 1999) collective farms/agricultural cooperatives/state farms and 71 (58 in 1999) private farms, whose proposals on water conservation were recognized original and were accepted by oblast expert councils for participation in the second stage of competition **(Table 2.1).**

1. SPECIFIC FEATURES OF GROWING SEASON 2000[3]

The second stage of competition was conducted in conditions of severe draught. Therefore, external factors assisted to participants to demonstrate practically real ways of overcoming water crisis in complex situation.

Draught of 2000 sharply aggravated water-economic complex functioning in the AmuDarya and SyrDarya basin. Available water resources and river systems, Priaralie and the Aral Sea ecological sustainability were substantially reduced. Under these conditions it is necessary to plan and manage water-economic complex functioning very properly. Planning, in turn, is based on reliable hydrological predictions provided by hydro-meteorological service. Nevertheless, due to lack of equipment and number of observation points reduction, information field has being limited, that affected forecast quality.

[3] *Were used the materials of 28th meeting of ICWC*

TABLE 2.1

Objects selected for the II stage of competition by oblast expert councils

Republic	Oblast	Years	TOTAL	including:			
				Water farms	WUA	Collective farms, state farms, cooperatives	farmers
Kazakhstan	Kzylorda*)	1999	7	3	0	2	2
		2000	26	6 (3) *)	0	8 (6)	12 (12)
	South Kazakhstan *)	1999	21	3	4	6	8
		2000	21	3	3 (1)	7 (4)	8 (3)
Kyrgyzstan	Jalalabad*)	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)
Tajikistan	Leninabad	1999	12	4 (1)	0	6	2
	Sogd **)	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	**Per region:**	**1999**	**142**	**25**	**12**	**47**	**58**
		2000	**167 (80)**	**29 (10)**	**10 (4)**	**57 (22)**	**71 (44)**

*) In parentheses gave a number of new participants (since April 1, 2000).
**) In autumn 2000 Leninabad oblast of Republic of Tajikistan was renamed in Sogd oblast.

For example, according to the forecast for 1998, water resources availability in the SyrDarya basin was expected as 81% of norm, but actual one amounted for 124%. In result of this mistake erroneous plan for water reservoirs cascade operation regime has been adopted and in June 1998 about 1 km^3 water was released to the Arnasay depression that is exclusive case for growing season.

During growing season 2000, on contrary, actual water resources in the SyrDarya basin amounted 75% of norm and 81% of value predicted by Glavgidromet **(Table 2.2).**

Even more dramatic situation occurred in the AmuDarya basin. Actual water resources amounted for 71.8% of norm and 77.2% of value predicted by Glavgidromet.

TABLE 2.2

Water resources of the AmuDarya and SyrDarya basin during growing season 2000 (according to BVO "AmuDarya" and BVO "SyrDarya" for the period since 01.04.2001 till 30.09.2001).

Name	Unit	Norm	Predic-tion	Actual	Deficit	
					from the norm	from prediction
AmuDarya river basin	km^3	47.592	44.261	34.182	13.410	10.079
SyrDarya river basin	km^3	29.302	27.082	21.955	7.347	5.127
For two basins	km^3	76.894	71.343	56.137	20.757	15.206

During non-growing period there were obliged water releases to the Aranasay depression. It has happened due to the Toktogul reservoir operation in power mode during winter time and limited SyrDarya river channel capacity downstream Chardara. During non-growing period 1999-2000 2.81 km^3 of water were released to the Arnasay depression.

Water supply to Priaralie and the Aral Sea was 0.614 km^3 (plan is 3.0km^3) in the AmuDarya river basin and 2.7 km^3 (plan is 2.8 km^3) in the SyrDarya basin. It means that in summer there will be tense ecological-sanitary situation, especially in the AmuDarya basin.

On this background water supply to water consumers over whole period of growing season, and especially in July-August, was extremely uneven **(Table 2.3, Fig. 2.1 and 2.2).**

TABLE 2.3

Water supply regularity over the countries of the Aral Sea basin during growing season 2000 (percentage of limits established by ICWC)

State	April	May	June	July	August	Septem-ber	Vegetation
AmuDarya river basin							
Tajikistan	100	97	76	76	80	90	84
Turkmenistan	91	84	73	59	55	57	69
Uzbekistan	107	67	68	51	49	95	64
SyrDarya river basin							
Kazakhstan («Dostyk»)	50	110	127	74	70	125	85
Kyrgyzstan	115	120	120	115	116	285	125
Tajikistan	97	97	108	106	122	104	107
Uzbekistan	115	106	80	75	103	168	97

FIGURE 2.1

Water supply regularity related to established limits (AmuDarya basin, growing season 2000)

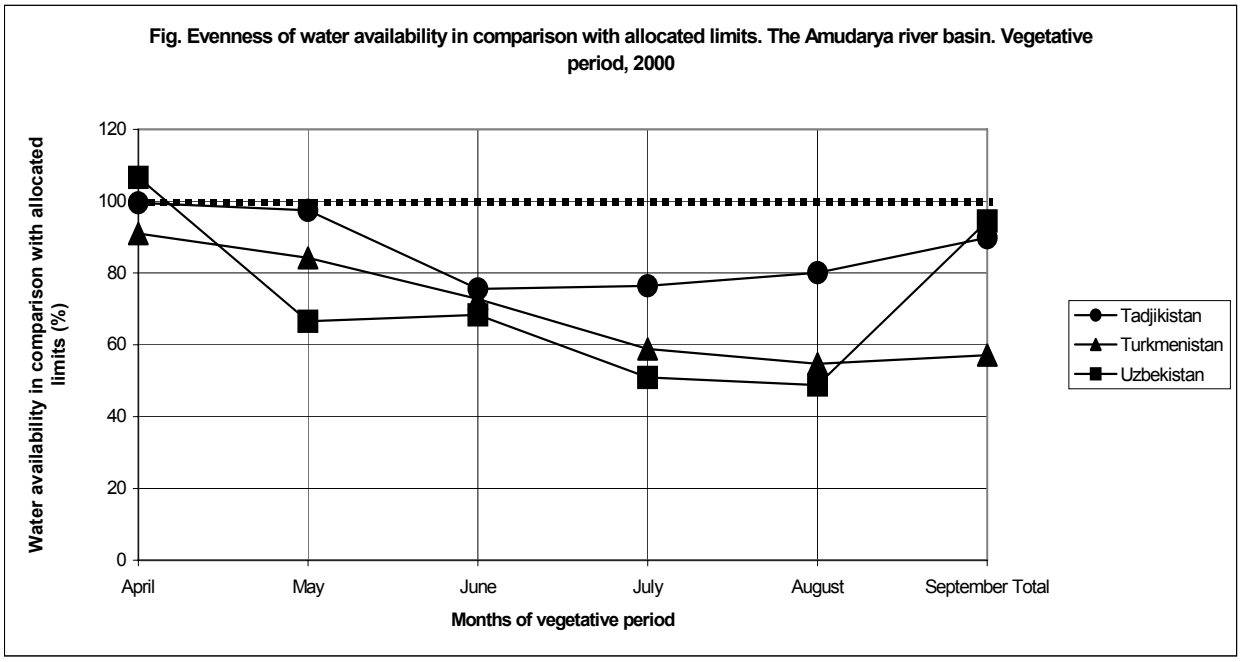
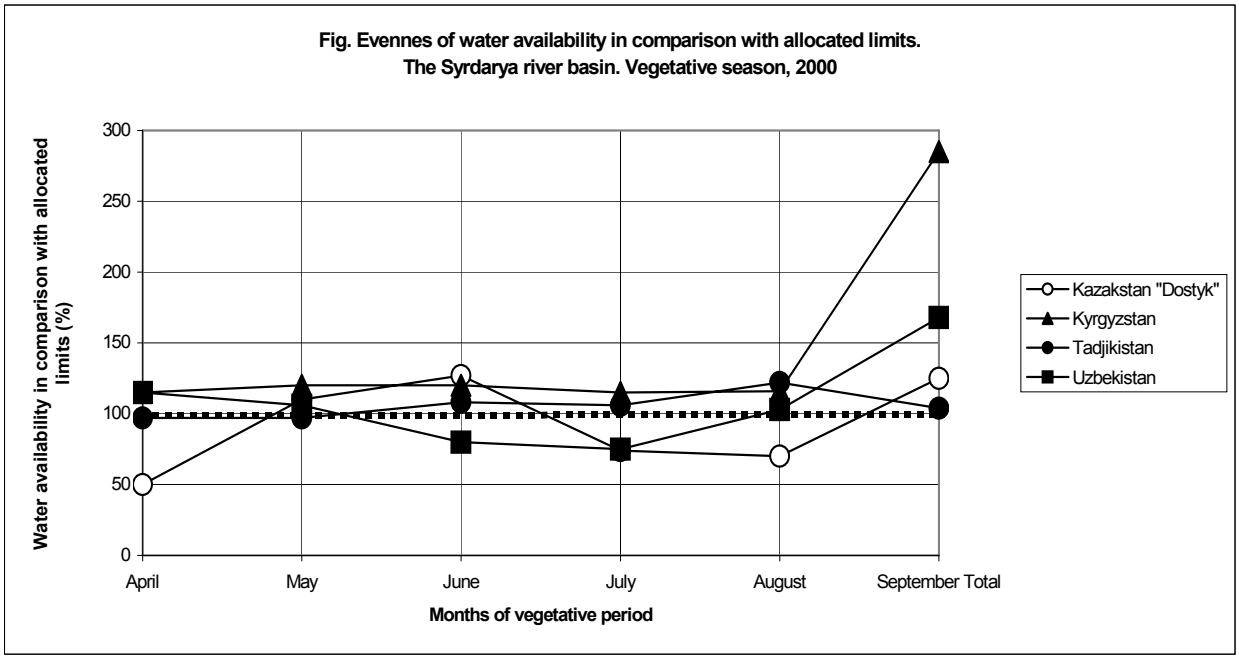


FIGURE 2.2

Water supply regularity related to established limits (SyrDarya basin, growing season 2000)



2. CHARACTER AND STRUCTURE OF PROPOSALS ON LOSSES REDUCTION AND IRRIGATION WATER RATIONAL UTILIZATION

Proposals used by competition participants can be classified into 4 major directions presented in **Table 2.4.**

TABLE 2.4

Major water conservation measures undertaken by competition participants

Technical	• Complex or partial modernization of irrigation systems; • Canals lining; • Irrigated plots leveling; • Irrigation systems' water-metering improvement
Technological	• Water registration improvement; • Collector-drainage water re-use for irrigation; • perfect irrigation technique and technology introduction; • soil fertility improvement by agrotechnical methods; • water allocation organization and technology perfection; • irrigation in shortened furrows; • "tier" irrigation; • irrigation to successive irrigated and "dry" furrows; • film cover application for furrow ridges; • "night" irrigations; • recharge irrigations; • releases in-contour use; • differentiated water supply (selected irrigation with regard for plant state); • sowing over ridges; • irrigation by variable jet; • collector-drainage water use in combination with irrigation water
Organizational	• management's organizational structure improvement under market conditions; • WUA establishing in irrigated farming; • Cropping pattern changing (introduction of draught-resistant and salt-tolerant crop species); • Cropping pattern adaptation to limited water use; • On-farm irrigation under limited water use ("fields-indicators") organization; • "cumulated" irrigations; • inter-farm and on-farm water rotation organization; • organization and currying out "night" irrigations; • water supply to the field under its readiness to irrigation
Economic	• economic incentives for water conservation under strict limitation of technological needs with minimal charge for share corresponding to crop biological requirements and increased charge for excessive water consumption

According to “Uzvodproekt”, maximum reduction of all types of losses is distributed over irrigation system’s elements as follow:

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

Necessary investments in losses reduction are as follows:

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

Range of simple and cost-effective methods of water conservation increases, at some extent, water use effectiveness and irrigation productivity, but wide scale water conservation and land quality improvement is possible only through substantial investments to irrigation infrastructure and technology.

Significance of activity within the competition is defined by revealing positive experience accumulated by water users themselves without any intervention from the “top”. That is why it is not scientific experiment, which farmers and agricultural cooperatives are ready to carry out, being stimulated, but that they found on own fields as a measure on water resources rational use. It is necessary to understand clearly: all done by water users in water conservation is not experiment forced from the “top”, but specific practice of irrigated agriculture in separate zones of the region which can be disseminated. Understanding of this is very important also from water conservation sustainability point of view. It is evident, that demonstrated practice existed before competition. Competition only facilitated water conservation practical methods further dissemination and public information. Change in attitude to water is important winning of the competition. Just competition stimulated increase of on-farm irrigation network water-metering degree in Ferghana, Jalalabad, Osh and Sugd oblasts.

Major incentives for water conservation under current economic and social development level are presented in **Table 2.5.**

In **Table 2.6** data about most widely spread methods of water conservation are summarized.

TABLE 2.5

Incentives for water conservation on objects of competition "Water conservation" within sub-component A-2

	Incentives	Zones of factor's actual influence on competition's objects
1	Low water availability of irrigation systems	• Kashkadarya oblast • South-Kazakhstan oblast • Sugd oblast
2	Paid water use	• Kyzylorda oblast • South-Kazakhstan oblast • Osh oblast • Jalalabad oblast • Sugd oblast • Khatlon oblast
3	Realization of public necessity for irrigation water saving	• Ferghana oblast • Jalalabad oblast

Note: Factors are presented in order of their impact significance for water conservation.

TABLE 2.6

Analytical recommendations on practical water conservation technology (without additional capital costs) demonstrated within sub-component A-2

No	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 cultivation's 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 ▪ Leninabad ▪ 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	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	It is widely used in the Competition objects located on the irrigated lands with medium and heightened

No	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
		the organization 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 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.	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.	slopes, in the following oblasts: ▪ Ferghana ▪ Kashkadarya ▪ Leninabad ▪ Osh ▪ Djalalabad ▪ 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 ▪ Leninabad ▪ Osh ▪ Djalalabad ▪ South Kazakstan ▪ Khatlon

No	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
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 ▪ Leninabad ▪ Osh ▪ Djalalabad ▪ South Kazakstan ▪ Khatlon

3. REVIEW OF DATA CHARACTERIZING WATER CONSERVATION AND RATIONAL WATER USE

3.1. Main provisions

Notion of water conservation in irrigated farming, and particularly in market-oriented economy, is significantly wider than simple water expenses reduction. Water conservation system includes wide range of questions: reclamation regimes optimization on background of drainage and irrigation technique, agrotechnical methods, increasing soil fertility, irrigation technique and technology perfection, etc. Goal of water saving on irrigated lands is agricultural production under which, along with rational water use, optimal level of agricultural crops yield and production profitability are provided.

Sustainability and success of agricultural production factors use and crop yield increase (social-economic aspect) simultaneously with irrigation water saving (ecological aspect) were evaluated through practical demonstration of methods used by competition's participants.

It is expedient to consider main tendencies revealed during 2-year competition. Let us consider the following elements of water conservation system:

- Cropping pattern on irrigated lands
- Water saved during growing season
- Major crops yield
- Gross product
- Agricultural production cost
- Gross margin
- Water and land use productivity.

3.2. Cropping pattern on irrigated lands

Compared with 1999 irrigated area under command of rayon water organizations increased on 161.3th. ha. This growth is caused mostly by bigger number of competition's participants and replacement of some organizations by others. Nevertheless, like 1999 major crops are presented by cotton – 33.8% of total area (37.5% in 1999), winter wheat – 17.9% (19.5% in 1999), alfalfa – 10.5% (7.0% in 1999), rice – 6.8% (3.3% in 1999) **(Table 2.7 and Fig. 2.3).**

TABLE 2.7

Cropping pattern on irrigated lands under command of rayon water organizations-competition's participants

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

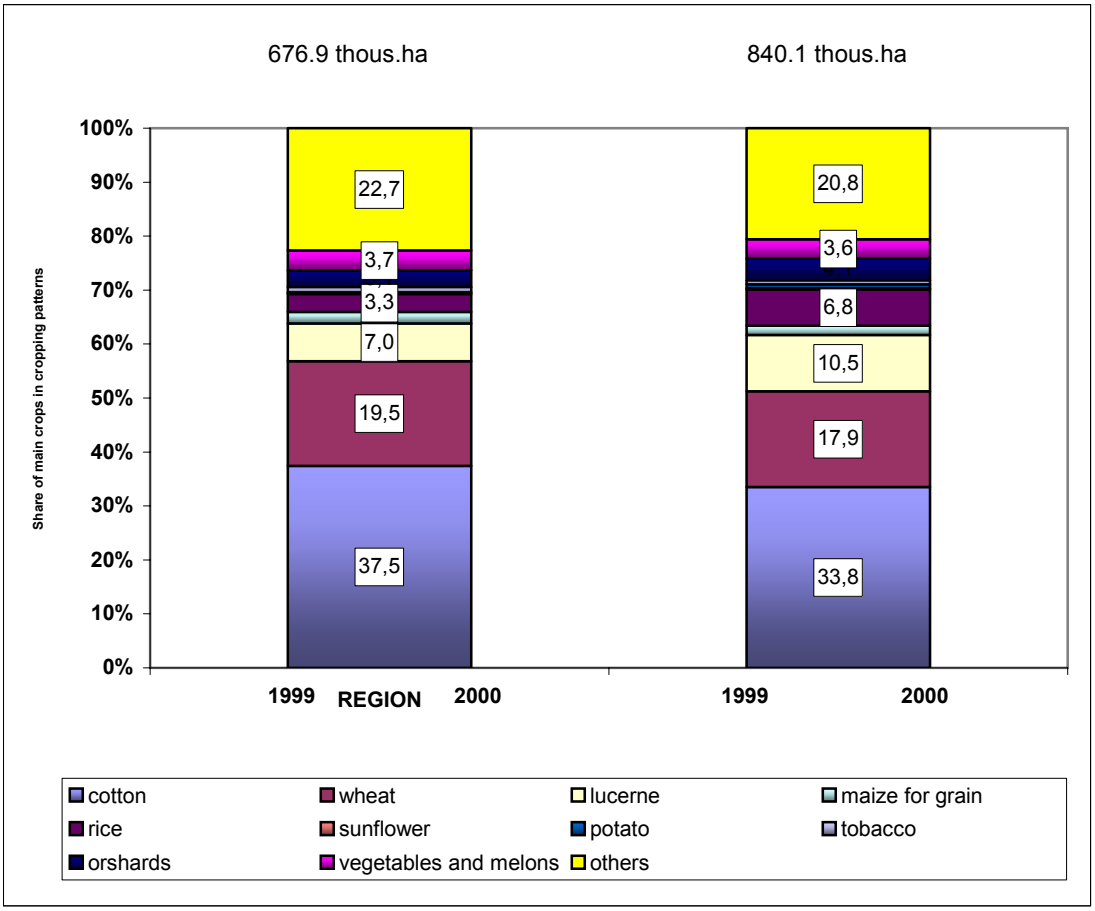
TABLE 2.8

Water diversion reduction with regard for established limits for growing season (at level of rayon water organizations-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

FIGURE 2.3

Cropping patterns on irrigated lands



More detailed cropping pattern is presented in **Annex B**.

The highest share of cotton occurs in South-Kazakhstan oblast (61.2%), winter wheat – in Osh oblast (31.3%), alfalfa – in Kyzylorda oblast (30.3%), rice-also in Kyzylorda oblast (41.3%).

3.3. Water resources conservation during growing season

As an indicator of water conservation difference between actual water diversion for irrigation and established limit for growing season 2000 is taken **(Annex C)**.

Water diversion limits per complex hectare were 13.34 th.m^3 /ha on average (against 12.60 th. m^3/ha), e.g. increased on 0.74 th. m^3/ha **(Table 2.8).** Water diversion limits growth is caused by limit increase per complex hectare for water organizations participating in competition 2000 on Osh, Sugd, Khatlon and Kashkadarya oblasts.

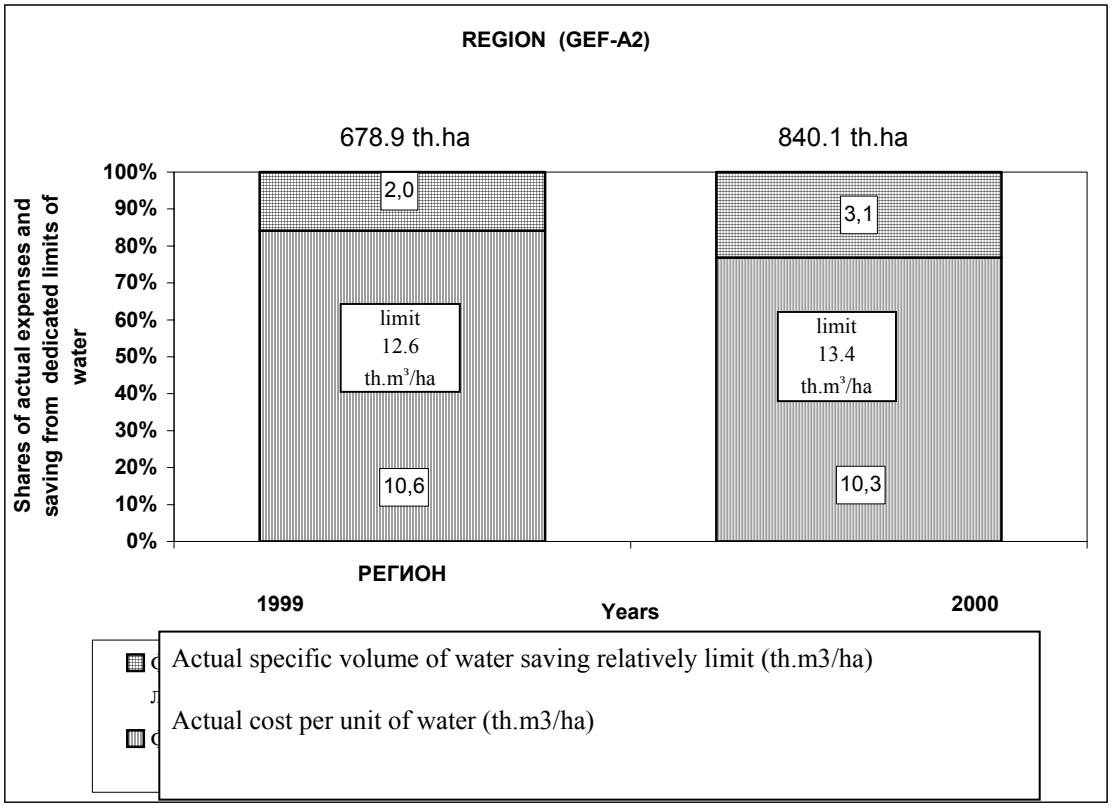
Water expenses reduction per complex hectare at the level of water supply to rayon water organizations was negligible compared with 1999 (0.36 th. m^3/ha), e.g. within discrepancy of measurements. In three oblast actual water expenses increased:

- In Khatlon oblast – on 1.95 th. m^3/ha (16.75 th. m^3/ha in 2000 against 14.80 th. m^3/ha in 1999);
- In Sugd oblast – on 1.08 th. m^3/ha (15.11 th. m^3/ha in 2000 against 14.03 th. m^3/ha in 1999);
- In Osh oblast – on 0.72 th. m^3/ha (9.07 th. m^3/ha in 2000 against 8.35 th. m^3/ha in 1999);

Total for the region water diversion reduction amounted for 2.6 km^3 (against 1.4 km^3 in 1999) or 3.09 th. m^3/ha (against 2.0 th. m^3/ha in 1999) **(Fig. 2.4)**.

FIGURE 2.4

Water diversion reduction compared with limits established for the growing season



Contributions from oblasts-participants are as follows:

- Kyzylorda oblast 25 %
- South-Kazakhstan oblast 31 %
- Jalalabad oblast 6 %
- Osh oblast 6 %
- Sugd oblast 16 %
- Khatlon oblast 5 %
- Ferghana oblast 0 %
- Kashkadarya oblast 11 %

Four priority areas can be distinguished according to their impact:

- Impossibility to take allocated limit physically because of water deficiency in sources;
- Exceeding real crop water requirements by allocated limits;
- Water users willing to cut expenses for irrigation water charges (Kazakhstan, Kyrgyzstan);
- Recognizing water conservation necessity particularly during the draught.

Attempt has been undertaken to evaluate approximately water resources use effectiveness during the growing season 2000 basing on data from rayon water administrations.

Analyzing cropping pattern and crop water consumption based on irrigation norms "net-field" given in the reports of national monitors, water use in irrigation system coefficient was preliminary assessed and compared with similar indicator for 1999 **(Table 2.9)**.

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

Where

WUC - coefficient of water use in irrigation system
r - useful crop water consumption, net irrigation norm, m^3/ha
F - irrigated area of the system, ha
W - water diversion to irrigation system, m^3

TABLE 2.9

Evaluation of irrigation water use effectiveness

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 irrigation water use WUC (under mains, inter-farm and on-farm canals efficiency 65-75% and field water use efficiency 75-85%) amount for 55-65%.

WUC values less than 55% witness about ineffective water use and water conservation.

WUC values more than 65% witness about in-contour re-use under water deficit.

WUC values more than 75% witness about “severe” water deficit and low crop water availability.

Taking into account these criteria, water organizations worked under “severe” water deficit:

- South-Kazakhstan oblast (WU = 101%); particularly severe deficit occurred in Dostyk canal’s command zone;
- Kashkadarya oblast (WUC = 97%);
- Kyzylorda oblast (WUC =75%).

Next water organizations demonstrated rational water use:

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

Some water organizations having water conservation reserves reduced their indicators compared with 1999:

- Khatlon oblast (WUC = 35% against 43% in 1999);
- Osh oblast (WUC = 43% against 58% in 1999);
- Sugd oblast (WUC = 48% against 52% in 1999).

3.4. Major crops yield

Irrigation farming goal is to receive optimal yield under irrigation water rational use. From this point of view, water conservation measures effectiveness is assessed through irrigation water “re-payment” by yield. Data on crops yield obtained by various water users are presented in **Annex D**. Let us consider how draught 2000 affected major crops yield **(Table 2.10)**.

TABLE 2.10

Major agricultural crops yield

(ton/ha)

Oblast	Year	Crops											
		Cotton	Wheat	Lucerne	Maize for grain	Maize for silage	Rice	Sun-flower	Potato	Tobacco	Orchards	Vines	Vegeta-bles and melons
Kolkhozes, agricultural cooperatives													
Kzylorda	1999		2,27	7,41			3,75						5,80
	2000		0,88	1,33			4,03						1,13
(average acc. rayons)	***2000***		***0,96***	***0,85***	***3,40***		***3,93***	***1,20***	***9,46***				***11,45***
South Kazakhstan	1999	1,54	2,04	2,56		12,26	2,13						14,71
	2000	1,80	1,97	5,54		35,00	2,12				2,22		11,41
(average acc. rayons)	***2000***	***1,76***	***2,17***	***1,82***	***2,79***		***3,17***		***9,39***				***24,84***
Djalalabad	1999	2,60	3,47	21,78				1,20		2,18			
	2000	2,60	3,43		5,80			1,73		2,63			20,25
(average acc. rayons)	***2000***	***2,47***	***3,85***		***4,90***					***2,28***			***12,13***
Osh	1999		3,45							2,51			
	2000	3,00	4,25				1,76			1,62			
(average acc. rayons)	***2000***	***3,30***	***3,25***		***6,15***			***1,80***		***3,00***			***8,63***
Sogd	1999	2,30	3,08	15,45	2,72		2,63				0,19	4,13	34,73
	2000	3,00	2,89	22,16	6,40	27,32	3,24				3,51	2,20	26,34
(average acc. rayons)	***2000***	***2,15***											
Khatlon	1999	1,60	1,71	22,85			2,07						12,34
	2000	1,44	1,76	17,19	4,10		1,50						10,28
(average acc. rayons)	***2000***	***1,23***	***1,62***	***15,25***	***0,33***		***0,20***						***16,65***
Ferghana	1999	3,26	3,60										
	2000	3,45	4,86	14,85	5,77	24,71							16,19
(average acc. rayons)	***2000***	***2,82***	***3,47***	***1,90***	***2,69***								***6,07***
Kashkadary	1999	2,43	2,63	4,20	2,95	15,83							13,65
	2000	2,73	2,44	12,01	8,35	15,71							8,60
(average acc. rayons)	***2000***	***1,98***	***2,31***	***8,29***	***4,18***								
REGION	1999	2,29	2,78	12,38	2,84	14,05	2,65	1,20		2,35	0,19	4,13	16,25
	2000	2,57	2,81	12,18	6,08	25,68	2,53	1,73		2,13	2,86	2,20	13,46

Oblast	Year	Crops											
		Cotton	Wheat	Lucerne	Maize for grain	Maize for silage	Rice	Sun-flower	Potato	Tobacco	Orchards	Vines	Vegeta-bles and melons
(average acc. rayons)	***2000***	***2,24***	***2,52***	***5,62***	***3,49***		***2,43***	***1,50***	***9,43***	***2,64***			***13,29***
Private and peasant farms													
Kzylorda	1999												
	2000		0,88	1,33			4,03						1,13
(average acc. rayons)	***2000***		***0,96***	***0,85***	***3,40***		***3,93***	***1,20***	***9,46***				***11,45***
South Kazakhstan	1999	1,84											
	2000	2,49	2,60										
(average acc. rayons)	***2000***	***1,76***	***2,17***	***1,82***	***2,79***		***3,17***		***9,39***				***24,84***
Djalalabad	1999	2,70	2,73	7,84	4,72		3,20	1,30	21,20	2,25			12,19
	2000	2,67	3,47	6,40	5,40			1,44	11,90	2,65			12,50
(average acc. rayons)	***2000***	***2,47***	***3,85***		***4,90***					***2,28***			***12,13***
Osh	1999	3,35	3,73	6,47	5,84			1,72	11,76	2,60			28,57
	2000	3,30	3,67		5,40			1,65	15,00				25,00
(average acc. rayons)	***2000***	***3,30***	***3,25***		***6,15***			***1,80***		***3,00***			***8,63***
Sogd	1999	1,63	1,50										15,00
	2000	3,16	2,70	19,70		8,50					4,89	2,11	27,32
average acc. rayons)	***2000***	***2,15***											
Khatlon	1999	2,34	1,61	11,88	6,67		2,60				2,88		2,67
	2000	1,48	1,76	30,14		5,33	2,08						9,80
(average acc. rayons)	***2000***	***1,23***	***1,62***	***15,25***	***0,33***		***0,20***						***16,65***
Ferghana	1999	3,25	3,19	47,00	5,10	38,00							
	2000	3,73	3,55	35,95		18,59	2,98						27,39
(average acc. rayons)	***2000***	***2,82***	***3,47***	***1,90***	***2,69***								***6,07***
Kashkadarya	1999	3,00	2,45	7,48									
	2000	2,90	3,31	7,79									30,00
(average acc. rayons)	***2000***	***1,98***	***2,31***	***8,29***	***4,18***								
REGION	1999	2,59	2,54	16,13	5,58	38,00	2,90	1,51	16,48	2,43	2,88		14,61
	2000	2,82	2,74	16,88	5,40	10,81	3,03	1,55	13,45	2,65	4,89	2,11	19,02
(average acc. rayons)	***2000***	***2,24***	***2,52***	***5,62***	***3,49***		***2,43***	***1,50***	***9,43***	***2,64***			***13,29***

FIGURE 2.5

Cotton yield

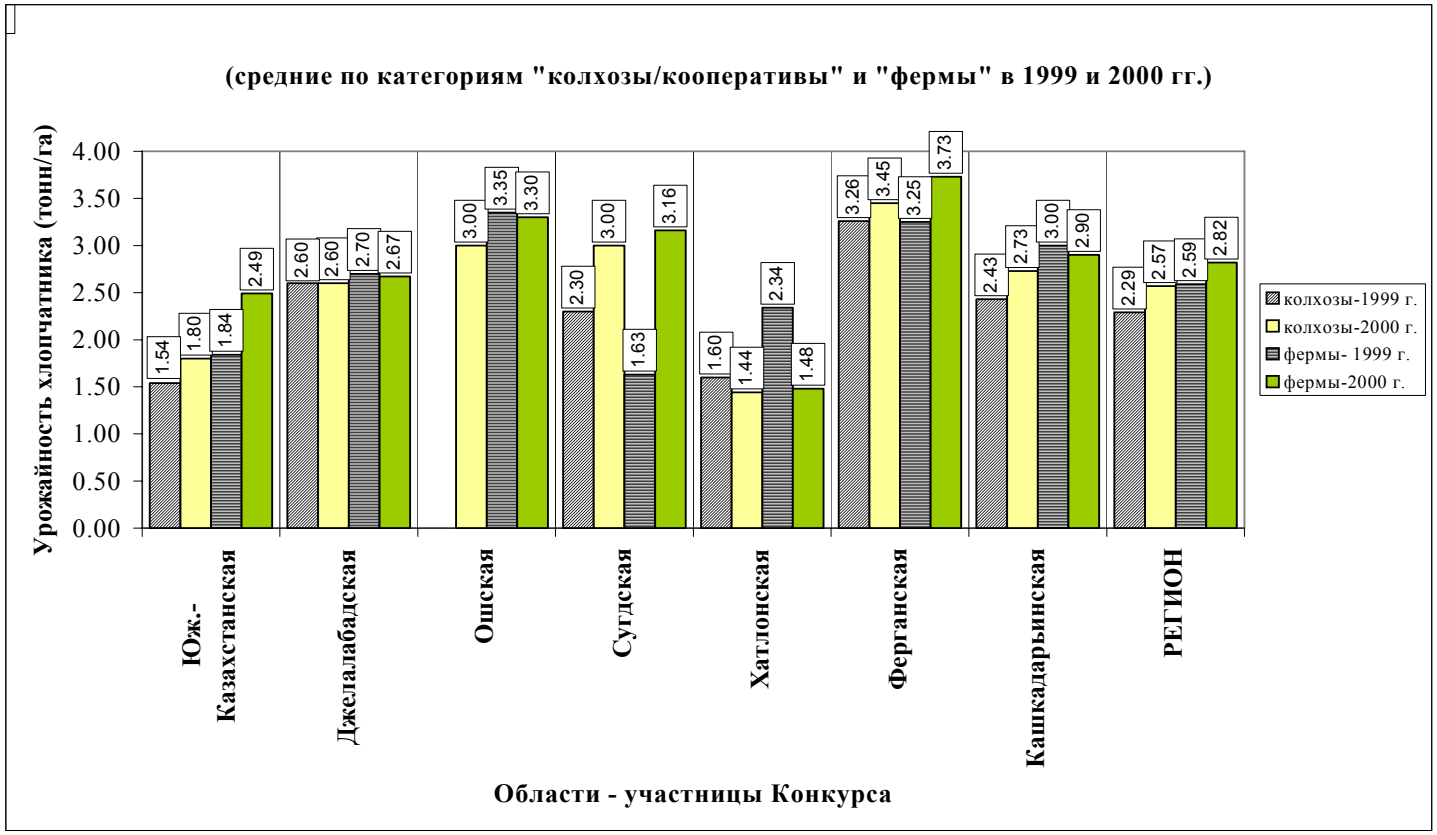


FIGURE 2.6

Winter wheat yield

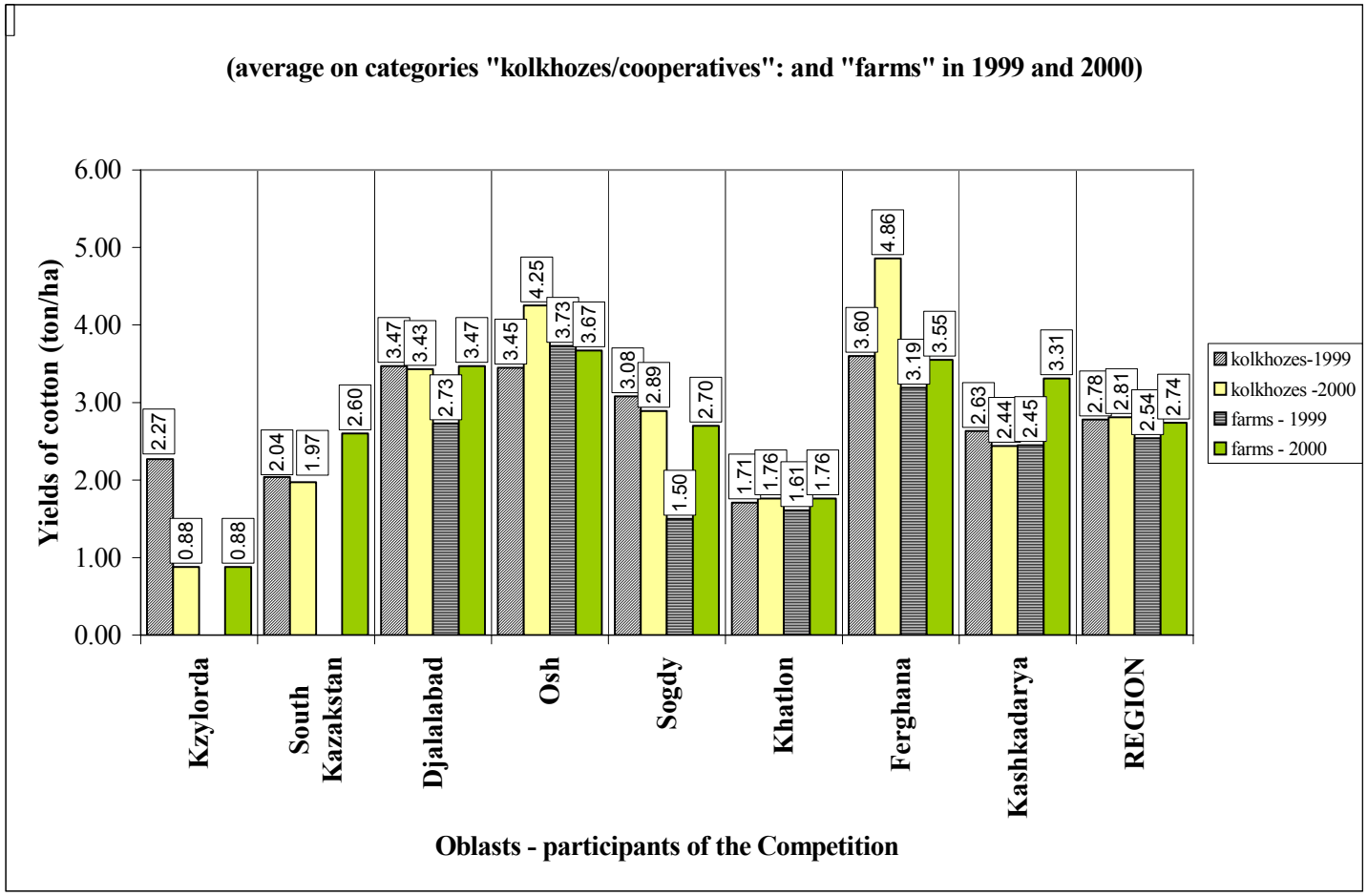
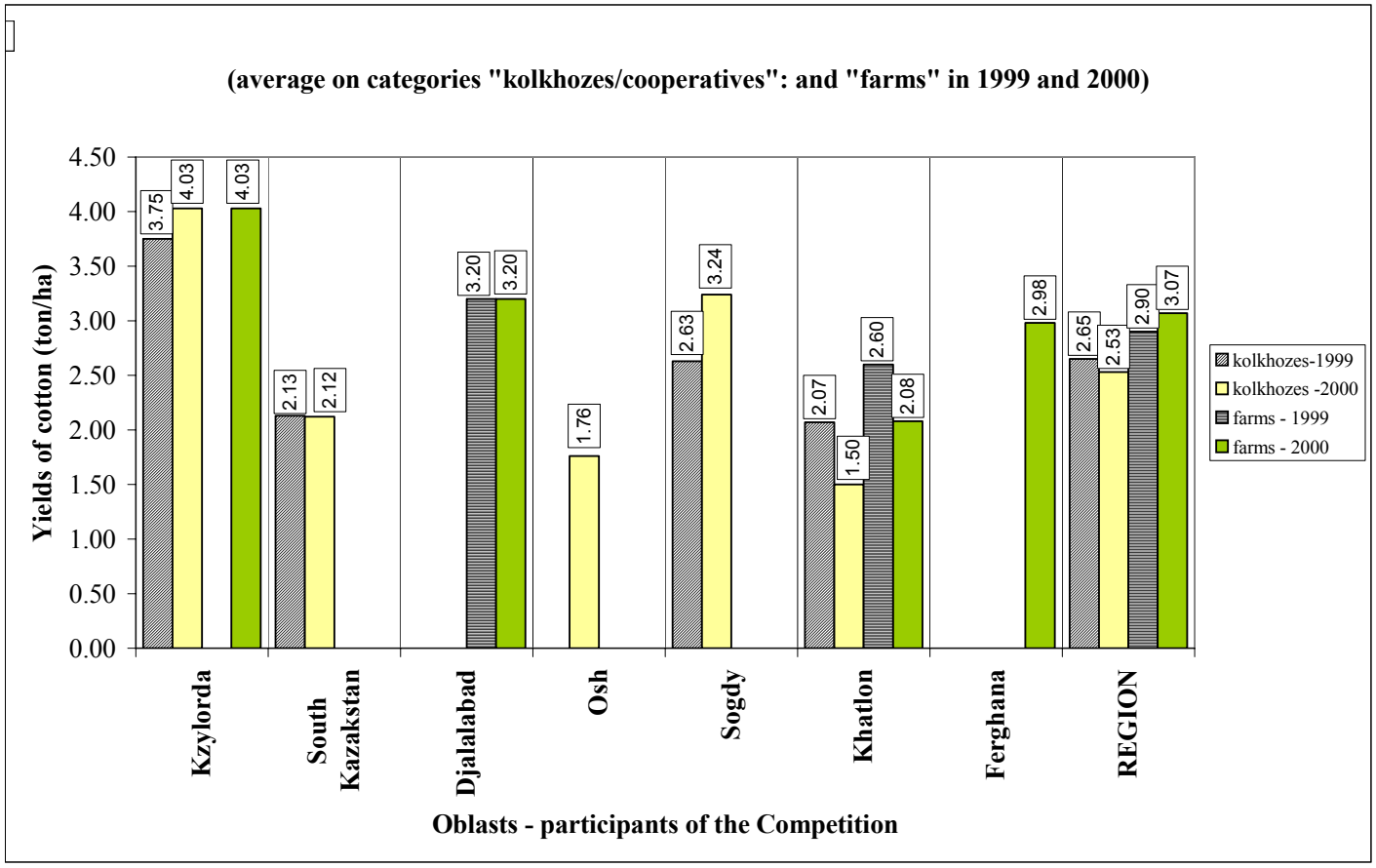


FIGURE 2.7

Rice yield



On cotton

Following *collective farms and agricultural cooperatives* achieved higher or equal yield indicators compared with 1999:

- Ferghana oblast – 3.45 t/ha against 3.26 t/ha in 1999 (yield at rayon level in 2000 - 2.82 t/ha);
- Sugd oblast – 3.00 t/ha against 2.30 t/ha in 1999 (yield at rayon level in 2000 - 2.15 t/ha);
- Kashkadarya oblast – 2.73 t/ha against 2.43 t/ha in 1999 (yield at rayon level in 2000 - 1.98 t/ha);
- Jalalabad oblast – 2.60 t/ha against 2.60 t/ha in 1999 (yield at rayon level in 2000 - 2.47 t/ha);
- South-Kazakhstan oblast – 1.8 t/ha against 1.54 t/ha in 1999 (yield at rayon level in 2000 - 1.76 t/ha);

In Khatlon oblast yield is higher than average rayon indicator (1.44 against 1.23 t/ha) but lower compared with average farm level in 1999 (1.60 t/ha).

Private and peasant farms achieving higher indicators compared with average rayon level and 1999 are the following:

- Ferghana oblast – 3.73 t/ha against 3.25 t/ha in 1999 (yield at rayon level in 2000 - 2.82 t/ha);
- Sugd oblast – 2.49 t/ha against 1.84 t/ha in 1999 (yield at rayon level in 2000 - 2.15 t/ha);
- South-Kazakhstan oblast – 3.45 t/ha against 3.26 t/ha in 1999 (yield at rayon level in 2000 -1.76 t/ha);

Next private farms reduced their indicators:

- Osh oblast – 3.30 t/ha against 3.35 t/ha in 1999 (yield at rayon level in 2000 - 3.30 t/ha);
- Kashkadarya oblast – 2.90 t/ha against 3.35 t/ha in 1999 (yield at rayon level in 2000 - 1.98 t/ha);
- Jalalabad oblast – 2.70 t/ha against 2.67 t/ha in 1999 (yield at rayon level in 2000 - 2.47 t/ha);

Especially high reduction is found in Khatlon oblast's private farms: 1.48 t/ha against 2.34 t/ha (yield at rayon level - 1.23 t/ha).

On winter wheat

Following *collective farms and agricultural cooperatives* achieved higher or equal yield indicators compared with 1999:

- Ferghana oblast – 4.86 t/ha against 3.60 t/ha in 1999 (yield at rayon level in 2000 - 3.47 t/ha);

- Osh oblast – 4.25 t/ha against 3.45 t/ha in 1999 (yield at rayon level in 2000 - 3.25 t/ha);
- Khatlon oblast – 1.76 t/ha against 1.71 t/ha in 1999 (yield at rayon level in 2000 - 1.62 t/ha);

Indicators of Kashkadarya oblast reduced to 2.44 t/ha against 2.63 t/ha in 1999 (yield at rayon level in 2000 - 1.62 t/ha);

Next private farms reduced their indicators:

- Jalalabad – 3.43 t/ha against 3.47 t/ha in 1999 (yield at rayon level in 2000 - 3.85 t/ha);
- Sugd oblast – 2.89 t/ha against 3.08 t/ha in 1999;
- South-Kazakhstan oblast – 1.97 t/ha against 2.04 t/ha in 1999 (yield at rayon level in 2000 - 2.17 t/ha);

Especially high reduction is found in Kyzylorda oblast's farms: 0.88 t/ha against 2.27 t/ha in 1999 (yield at rayon level - 0.96 t/ha).

Private and peasant farms achieving higher indicators compared with average rayon level and 1999 are the following:

- Ferghana oblast – 3.55 t/ha against 3.19 t/ha in 1999 (yield at rayon level in 2000 - 3.47 t/ha);
- Kashkadarya oblast – 3.31 t/ha against 2.45 t/ha in 1999 (yield at rayon level in 2000 - 2.31 t/ha);
- Sugd oblast – 2.70 t/ha against 1.50 t/ha in 1999;
- Khatlon oblast – 1.76 t/ha against 1.61 t/ha in 1999 (yield at rayon level in 2000 - 1.62 t/ha);

In Jalalabad oblast yield was 3.47 t/ha against 2.73 t/ha in 1999, but lower compared with 2000 (3.85 t/ha).

In Osh oblast yield was 3.67 t/ha against 3.73 t/ha in 1999 and 3.25 t/ha in 2000.

On rice

Following *collective farms and agricultural cooperatives* achieved higher or equal yield indicators compared with 1999:

- Kyzylorda oblast – 4.03 t/ha against 3.75 t/ha in 1999 (yield at rayon level in 2000 - 3.93 t/ha);

Yield lower than rayon indicators of 1999 was received:

- South-Kazakhstan oblast – 2.12 t/ha against 2.13 t/ha in 1999 (yield at rayon level in 2000 - 3.17 t/ha);

It worth to note, that draught did not impact significantly major crops yield except sharp reduction of winter wheat yield in South-Kazakhstan oblast (SyrDarya lower

reaches) and Kashkadarya oblast (AmuDarya middle reaches). Substantial cotton yield reduction occurred in Khatlon oblast (AmuDarya upper reaches): water factor was good but land reclamation state and poor agrotechnical practice were main causes of this reduction.

Therefore, mostly participants demonstrated stable results on background of lower water availability compared with 1999.

For more objective assessment of competition results, economic evaluation of agricultural production has been carried out based on monitoring data.

3.5. Gross product

Gross product is a volume of all agricultural production from irrigated area in monetary dimension.

In **Table 2.11** calculation of specific economic indicators[4] per one hectare of irrigated area over oblasts and competition's participants is presented.

Gross product obtained was 270-722$/ha. Its value is determined by yield, purchase price and type of product. Substantial share belongs to major crops like cotton, wheat and rice.

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

In other republics cotton prevail and amounts for:

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

Grain crops (winter wheat) are the second crop. In Tajikistan grains (mostly wheat) increase is observed in private farms compared with state farms **(Fig. 2.8 - 2.11)**.

[4] *Direct costs, production and gross margin were assessed. For comparison all costs are converted in $US according to official rate:*

- *Kazakhstan - 141.833 tenghe/1 $*
- *Kyrgyzstan - 47.677 som/1 $*
- *Tajikistan - 1.87 somoni/1 $*
- *Uzbekistan - 231.389 soum/1 $*

TABLE 2.11

Analysis of main indicators of agricultural production

Oblast	% from total irrigated area	Costs $/ha	Product $/ha	Benefit $/ha	Purchase price $/ton
WUA					
Osh	15,1	206,5	1303,2	1096,7	399
Jalalabad	38,6	209,7	1052,0	842,3	399
Kolkhozes, cooperatives					
South Kazakhstan	55,5	182,9	632,8	449,9	354
Osh	61,2	209,7	1195,5	985,8	399
Jalalabad	30,7	209,7	1025,1	815,3	399
Sogd	50,6	321,2	644,6	323,5	260
Khatlon	59,2	334,2	1064,4	730,2	572
Ferghana	40,1	755,5	822,3	66,7	243
Kashkadarya	34,4	589,4	680,9	91,5	252
Private farms					
South Kazakhstan	94,2	138,1	717,6	579,5	355
Osh	39,5	209,7	1199,9	990,1	399
Jalalabad	54,7	209,7	1028,6	818,9	399
Sogd	52,1	659,1	1182,2	523,1	271
Khatlon	42,1	391,5	860,9	469,4	437
Ferghana	67,0	744,8	907,3	162,4	236
Kashkadarya	52,3	280,1	617,7	337,6	219

FIGURE 2.8

Gross product distribution (Khatlon oblast - collective farms, cooperatives)

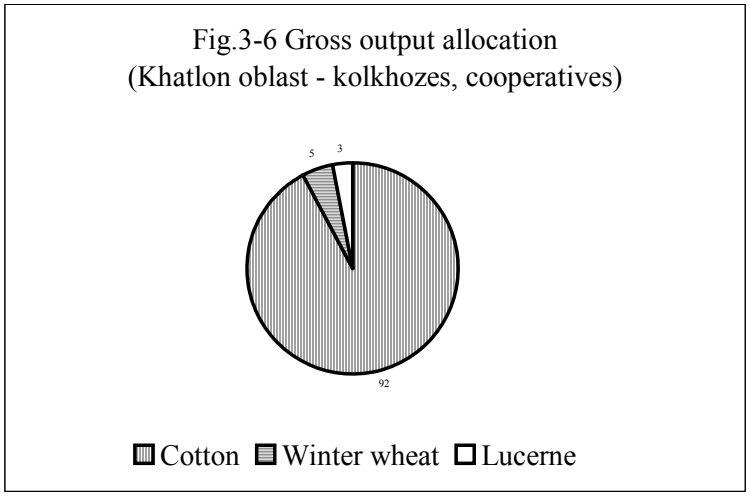


FIGURE 2.9

Gross product distribution (Khatlon oblast - farmers)

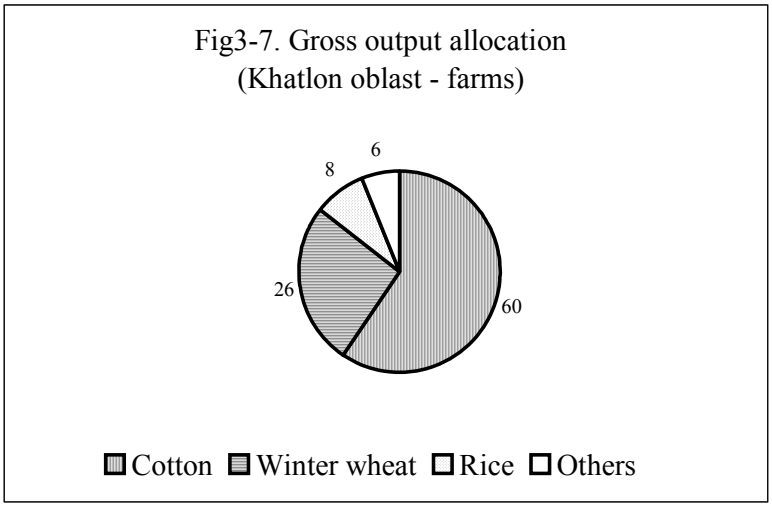


FIGURE 2.10

Gross product distribution (Jalalabad oblast - collective farms, cooperatives)

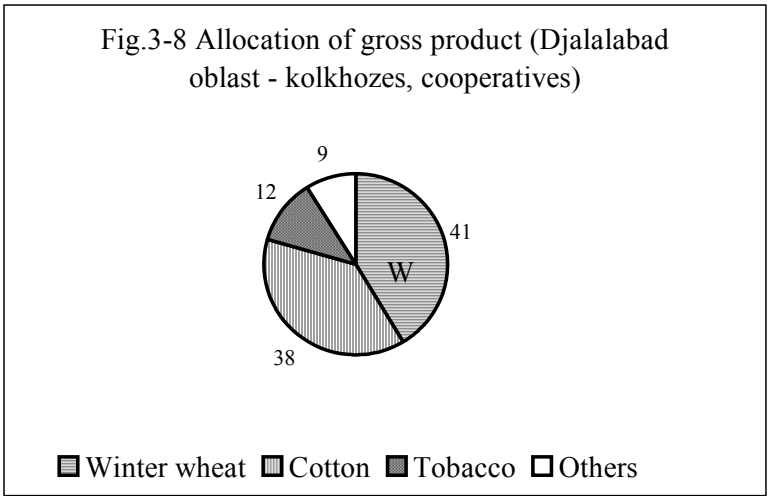


FIGURE 2.11

Gross product distribution (Jalalabad oblast - farmers)

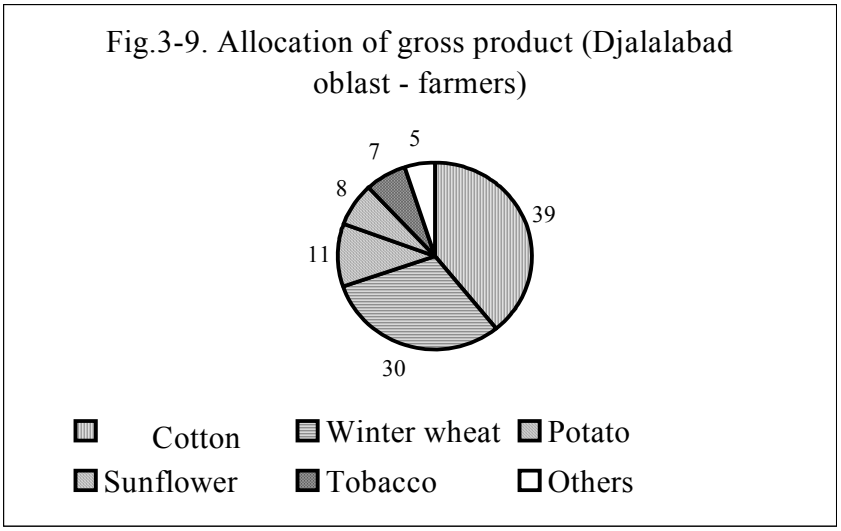


FIGURE 2.12

Gross product distribution (Ferghana oblast - collective farms, cooperatives)

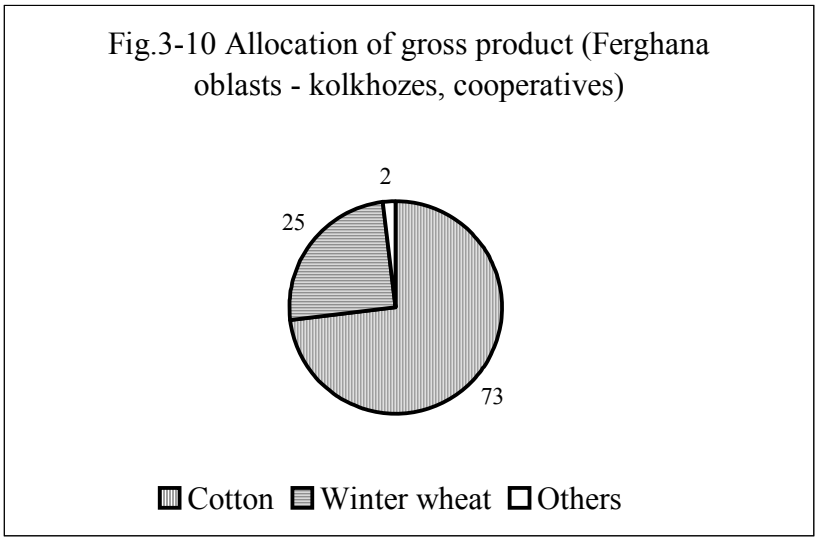
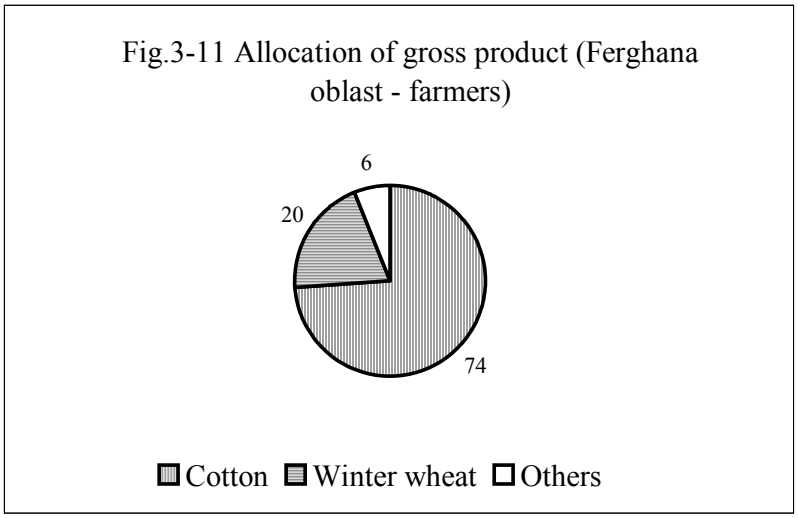


FIGURE 2.13

Gross product distribution (Ferghana oblast - farmers)



3.6. Agricultural production costs

While analyzing agricultural production, expenses for crop cultivation were taken into account. In western technology variable cost notion is used to calculate profit over crops. Direct costs do not contain general production expenses, taxes, etc. and determine profit over crops. Such methodology was used in WUFMAS project. Within sub-component A-2 under self-monitoring accounting was main source of information.

Average expenses per hectare of irrigated area for all farms equaled to 104-387 $/ha. Expenses higher than 500 $/ha are made in private farms of Khatlon and Ferghana oblasts. High expenses in Tajikistan were caused by high direct cost for cotton cultivation on the following farms: private farm “Gaforien” - cotton (1231 $/ha) and dekhkan farms “Gafurova” and “Samonien“ - wheat (1656 and 1045 $/ha, respectively).

In Ferghana oblast high level of cost is shown for all farms that led to gross margin reduction even under high yields. Comparison of costs for 1999 and 2000 shows that cost reduction in Kazakhstan and Uzbekistan and its growth in Kyrgyzstan and Tajikistan occurred.

Analysis of oblast and farm indicators shows: in Kazakhstan cost reduction in collective farms on 60$/ha and in private farms on 200 $/ha occurred. In Kashkadarya oblast cost reduction in all farms on 152 $/ha was observed, while in Ferghana oblast they remained high. In Kyrgyzstan cost reduction was found only in private farms of Osh oblast. Cost increase in Sugd oblast can be explained by erroneous data.

FIGURE 2.14

Cost analysis (collective farms, cooperatives)

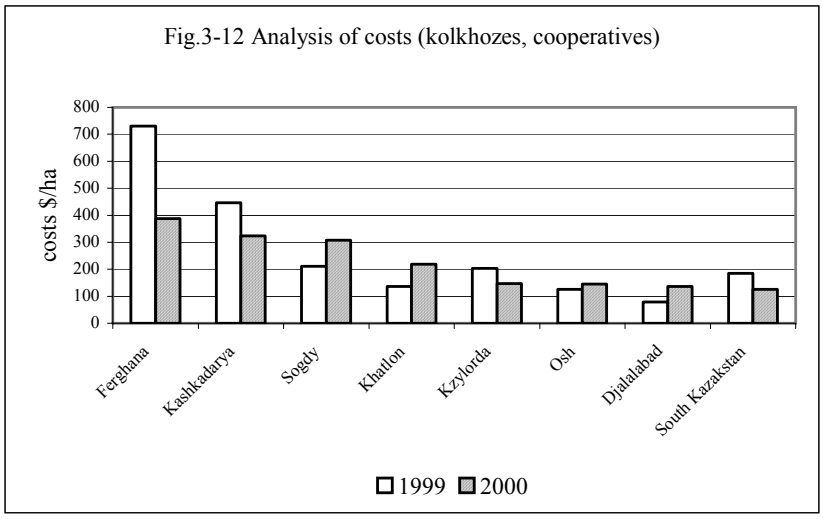
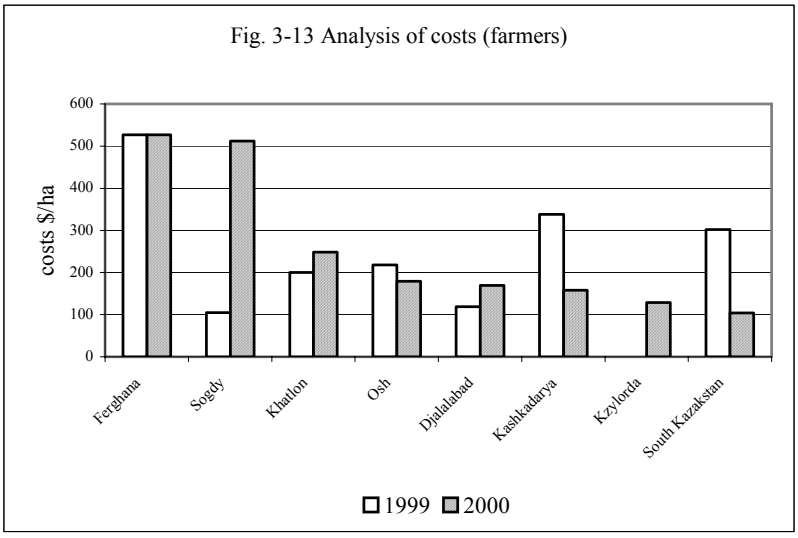


FIGURE 2.15

Cost analysis (farmers)



Indicators of average expenses for specific crops cultivation vary in wide diapason:

- Cotton –100-800 $/ha;
- Winter wheat – 10-450 $/ha;
- Alfalfa – 5-300 $/ha;
- Rice –100-300 $/ha.

These indicators not always fit to yield obtained. Cost can be determined through link between production and gross margin. Costs are expedient in case when they led to production and income increase. For example, cost increase in Ferghana oblast is justified by yield increase **(Fig. 2.16, 2.17).** But production efficiency does not increase and remains low (0.2-0.3 $/$).

FIGURE 2.16

Relationship between costs and cotton yield (Ferghana oblast, collective farms, cooperatives)

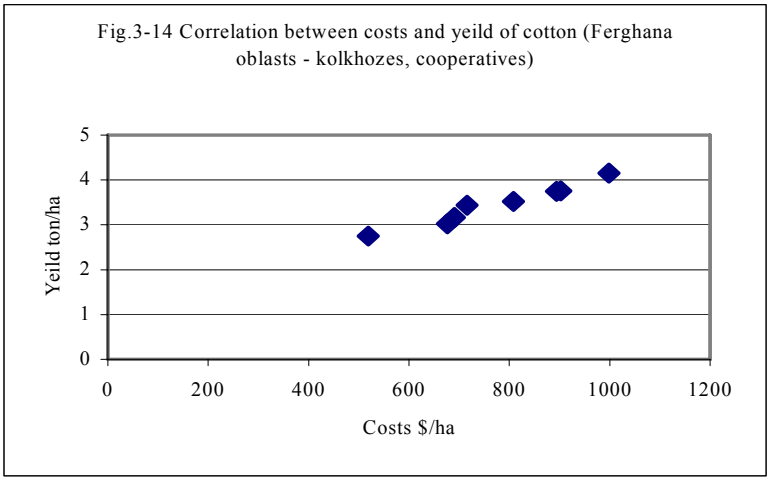
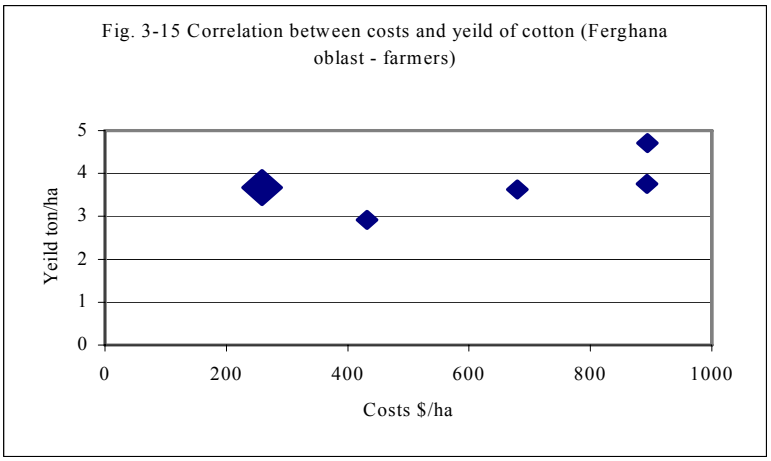


FIGURE 2.17

Relationship between costs and cotton yield (Ferghana oblast, farmers)



Relatively high recovery is obtained only in private farm “Yangi Hayot” where costs are 2 times lower compared with average (710 $/ha) in Ferghana oblast and amounted for 258 $/ha. Accordingly, cost recovery effectiveness increased respectfully **(Fig. 2.18, 2.19)** and amounted for 2.5 $/$.

FIGURE 2.18

Relationship between cotton yield and cost recovery (Ferghana oblast, collective farms, cooperatives)

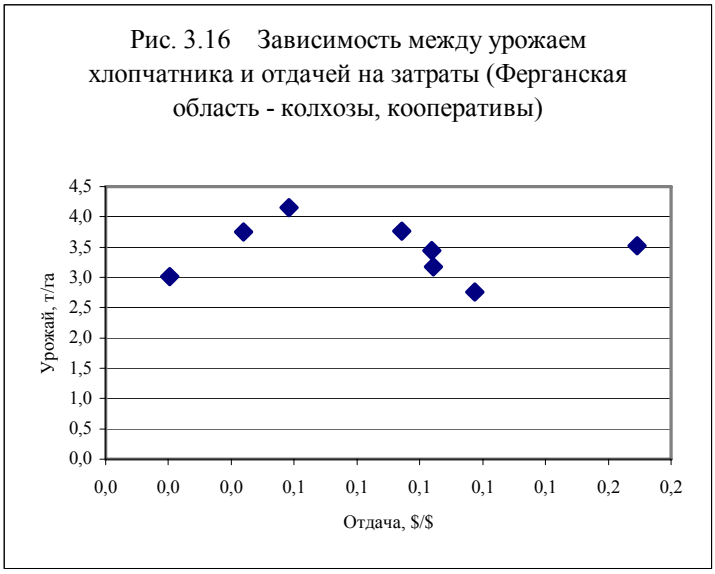
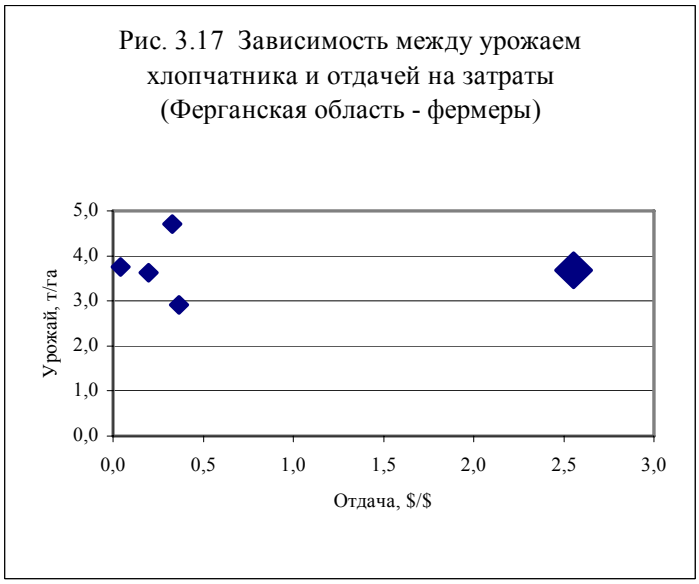


FIGURE 2.19

Relationship between cotton yield and cost recovery (Ferghana oblast, farmers)



Similar situation occurs when winter wheat is being grown: economically justified costs correspond to yield 4-4.5 t/ha and recovery 0.6 $/$. Cost increase reduces recovery (0.05 $/$).

Results show that in this case cotton growing effectiveness is determined by direct cost reduction and demonstrates once more, that for agricultural production increase it is necessary to increase productivity and reduce expenses.

3.7. Gross margin

Gross margin if defined as a difference between gross product and variable costs. Average gross margin for 2000 amounted for 50-550 $/ha. The highest margin is obtained in Kyrgyzstan (300-550 $/ha) by all categories of participants (WUA, collective farms/cooperatives, private farms) due to low expenses (130-180 $/ha) and high purchase prices for main agricultural crops (cotton-398 $/t, winter wheat- 147 $/t) **(Table 2.12).**

High margin (250-450 $/ha) in farms of Khatlon oblast under average crop productivity (cotton - 1.5 t/ha, winter wheat - 1.7 t/ha) could be obtained only due to unrealistic purchase prices (cotton - 450-570 $/t, wheat - 186 $/t).

In Sugd oblast gross margin is low due to high cost (510 $/ha).

In spite of production good indicators: high yield of major crops (cotton - 3.4 t/ha, winter wheat - 4.3 t/ha) and gross product (450-560 $/ha), in Ferghana oblast margin is insignificant (50-115 $/ha) due to high cost for agricultural production.

In Kashkadarya oblast due to cost reduction margin in the farms was the same as in Ferghana oblast even under worse indicators of production **(Fig. 2.20, 2.21)**.

TABLE 2.12

Analysis of irrigated crops production (average over categories)

Oblast	% from total irrigated area	Costs $/ha	Product $/ha	Benefit $/ha	Purchase price $/ton
Cotton					
WUA					
Osh	15,1	206,5	1303,2	1096,7	399
Jalalabad	38,6	209,7	1052,0	842,3	399
Kolkhozes, cooperatives					
South Kazakhstan	55,5	182,9	632,8	449,9	354
Osh	61,2	209,7	1195,5	985,8	399
Jalalabad	30,7	209,7	1025,1	815,3	399
Sogd	50,6	321,2	644,6	323,5	260
Khatlon	59,2	334,2	1064,4	730,2	572
Ferghana	40,1	755,5	822,3	66,7	243
Kashkadarya	34,4	589,4	680,9	91,5	252
Private farms					
South Kazakhstan	94,2	138,1	717,6	579,5	355
Osh	39,5	209,7	1199,9	990,1	399
Jalalabad	54,7	209,7	1028,6	818,9	399
Sogd	52,1	659,1	1182,2	523,1	271
Khatlon	42,1	391,5	860,9	469,4	437
Ferghana	67,0	744,8	907,3	162,4	236
Kashkadarya	52,3	280,1	617,7	337,6	219
Winter wheat					
WUA					
Osh	57,5	167,2	617,3	450,1	147
Jalalabad	28,2	220,2	502,6	282,3	147
Kolkhozes, cooperatives					
Kzylorda	11,4	56,2	102,4	46,2	85
South Kazakhstan	14,1	96,2	110,1	13,8	71
Osh	30,4	220,2	637,3	417,1	147
Jalalabad	36,0	220,2	513,0	292,8	147
Sogd	19,1	51,7	209,2	157,5	64
Khatlon	16,2	92,4	228,5	136,1	113
Ferghana	22,7	383,5	493,1	109,5	111
Kashkadarya	35,0	256,6	299,5	42,9	126
Private farms					
Kzylorda	30,6	53,5	75,4	21,9	85
South Kazakhstan	28,8	84,3	220,2	136,0	85
Osh	62,8	220,2	542,3	322,0	147
Jalalabad	52,7	217,7	510,9	293,2	147
Sogd	21,5	483,8	338,6	-145,2	144
Khatlon	57,6	119,8	280,9	161,1	187
Ferghana	39,7	309,3	366,8	57,4	91
Kashkadarya	42,0	127,8	263,1	135,4	99
Lucerne					
Kolkhozes, cooperatives					
Kzylorda	31,0	11,9	20,8	8,9	18
South Kazakhstan	12,3	38,4	53,7	15,3	18
Sogd	10,4	51,7	132,4	80,7	4
Khatlon	7,3	132,9	215,8	82,9	11

Oblast	% from total irrigated area	Costs $/ha	Product $/ha	Benefit $/ha	Purchase price $/ton
Ferghana	1,3	142,3	177,3	35,0	19
Kashkadarya	8,6	86,6	142,6	56,0	15
Private farms					
Kzylorda	27,5	6,5	133,6	127,1	73
Jalalabad	12,7	83,9	130,6	46,7	21
Sogd	10,1	29,2	162,9	133,7	13
Khatlon	17,1	60,1	374,6	314,4	12
Ferghana	27,6	129,0	361,1	232,0	11
Kashkadarya	30,9	63,5	173,0	109,5	14
Maize for grain					
WUA					
Osh	3,7	34,3	724,9	690,7	105
Jalalabad	5,8	125,8	447,7	321,8	94
Kolkhozes, cooperatives					
Jalalabad	36,8	125,8	547,4	421,6	94
Sogd	3,9	91,7	103,6	11,9	17
Khatlon	1,0	147,1	25,4	-121,7	11
Ferghana	0,8	194,9	283,6	88,6	74
Kashkadarya	2,5	352,6	542,1	189,5	102
Private farms					
Osh	18,5	125,8	566,3	440,5	105
Jalalabad	15,0	130,7	534,4	403,7	94
Ferghana	47,0	265,5	173,3	-92,3	19
Rice					
Kolkhozes, cooperatives					
Kzylorda	50,3	278,2	657,6	379,4	141
South Kazakhstan	18,4	109,7	439,5	329,9	212
Osh	8,4	10,5	369,7	359,2	210
Sogd	13,6	39,7	211,9	172,2	66
Khatlon	1,0	427,8	620,9	193,0	567
Private farms					
Kzylorda	52,0	296,2	553,8	257,6	141
Khatlon	62,5	207,2	505,9	298,7	294
Ferghana	10,0	1071,8	2571,4	1499,6	863
Tobacco					
WUA					
Osh	2,8	165,1	1266,6	1101,5	419
Jalalabad	2,9	157,3	1046,5	889,2	419
Kolkhozes, cooperatives					
Osh	7,3	157,3	679,6	522,3	419
Jalalabad	7,3	157,3	1135,4	978,1	419
Private farms					
Jalalabad	17,2	141,6	1111,6	970,1	419

FIGURE 2.20

Margin formation (collective farms, cooperatives)

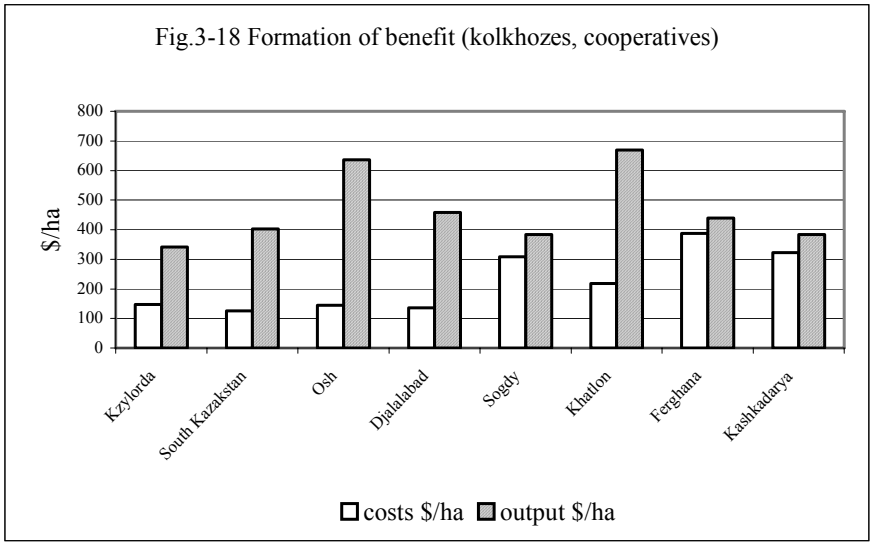
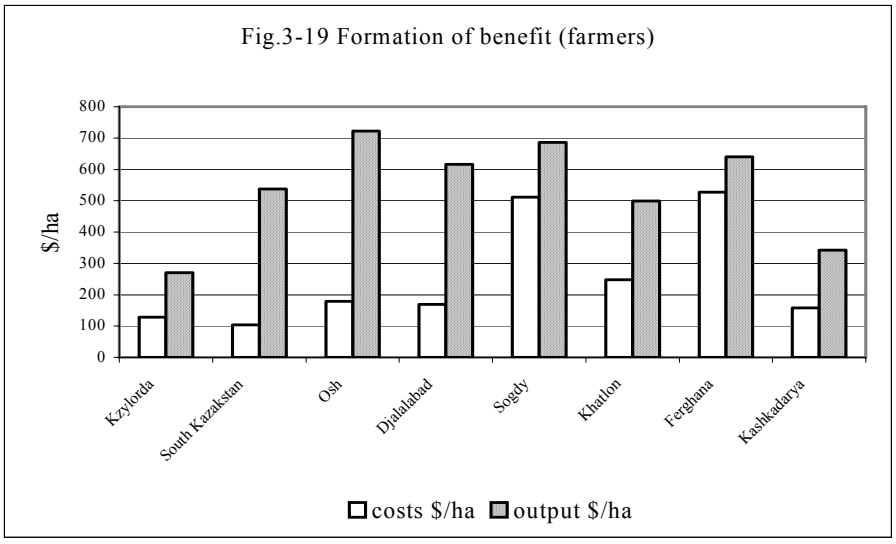


FIGURE 2.21

Margin formation (farmers)



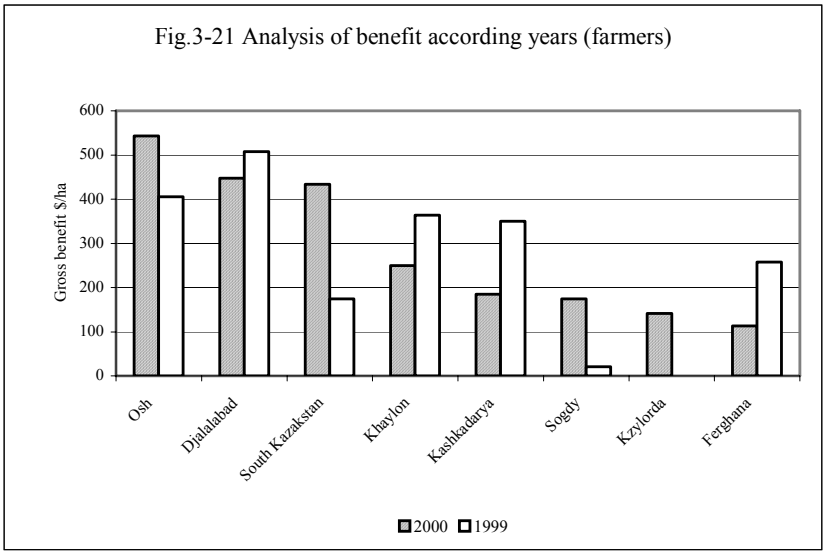
On **Fig. 2.22, 2.23** comparison of gross margin over years is presented including all farms-participants.

FIGURE 2.22

Margin analysis over years (collective farms, cooperatives)

FIGURE 2.23

Margin analysis over years (farmers)



Since participants composition somewhat changed, comparison was made to reveal some general tendencies. In general, gross margin increased in 2000 in farms of Kazakhstan. In other republics' farms it reduced. Particularly, this reduction is remarkable in the farms of Uzbekistan.

Most profitable crops are the following (**Table 2.12**):

- Cotton-gross margin equals up to 1000 $/ha;
- Winter wheat-gross margin equals up to 450 $/ha (only for Osh oblast of Kyrgyzstan);

- Maize for grain-gross margin equals up to 300-700 $/ha;
- Tobacco-gross margin equals up to 1000 $/ha;
- Potato-gross margin equals up to 800-1000 $/ha (for Osh and Jalalabad oblasts);
- Rice-gross margin equals to 300-1500 $/ha (for Uzbekistan and Kazakhstan).

3.8. Productivity of production factors use

Results of agricultural activity can be followed analyzing productivity indicators. This analysis is performed for three major indicators:

- Recovery from land ($/ha);
- Recovery from investments ($/$);
- Recovery from water ($/th. m^3).

Productivity indicator is gross margin/irrigated area/cost/water spent ratio **(Table 2.13)**.

TABLE 2.13

Productivity of agricultural production factors use

Oblast	Return for land	Return for investments	Return for water
	$/ha	$/$	$/thousands m^3
Water User Associations			
Jalalabad	551.3	2.8	107.5
Osh	606.5	3.6	89.4
average	**578.9**	**3.2**	**98.5**
Kolkhozes/agricultural cooperatives			
Kzylorda	204.9	1.3	10.1
South-Kazakhstan	278.1	2.2	29.0
Jalalabad	469.3	2.4	103.9
Osh	684.5	3.4	116.5
Sugd	129.4	0.6	10.6
Khatlon	529.4	2.1	47.1
Fergana	54.8	0.1	17.9
Kashkadarya	59.9	0.2	12.9
average	**301.3**	**1.5**	**43.5**
Private Farms			
Kzylorda	144.8	1.1	9.2
South-Kazakhstan	570.8	4.2	112.1
Jalalabad	468.5	2.6	86.6
Osh	543.2	3.0	81.4
Sugd	174.2	0.3	30.8
Khatlon	241.6	1.0	17.5
Fergana	117.7	0.2	21.9
Kashkadarya	185.0	1.2	51.1
average	**305.7**	**1.7**	**51.3**

Recovery from land (margin from irrigated area)

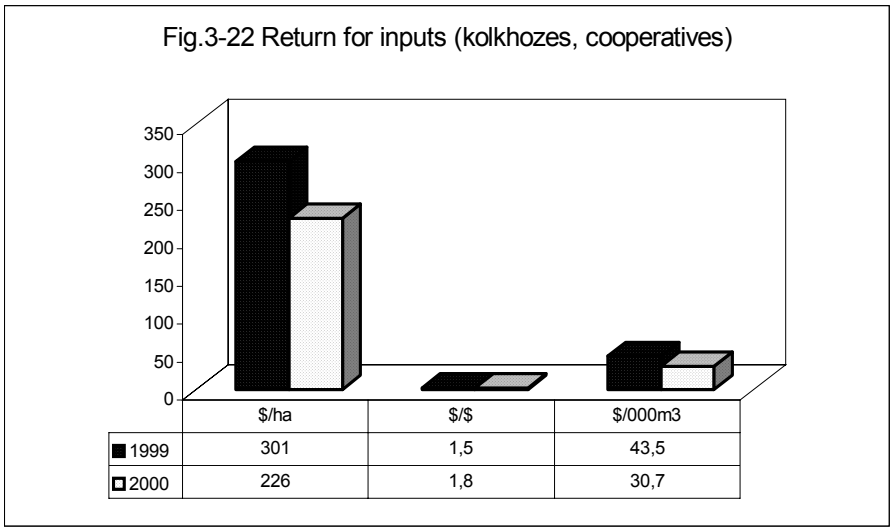
Land resources of a farm are a basis for gross margin calculation, e.g. they are limiting factors of agricultural production. Margin per hectare is a base for production planning. Planning objective is maximal margin obtaining under minimal costs.

Comparing indicators **(Fig. 2.24, 2.25)** of average recovery from landing 2000 and 1999 over the region as a whole, average values of this indicator increased in collective farms/cooperatives on 33%, in private farms they reduced on 10%. Reduction occurred mostly at expense of private farms of Uzbekistan and Tajikistan (from 318 to 185 $/ha in Kashkadarya oblast, from 258 to 118 $/ha in Ferghana oblast and from 364 to 24 $/ha in Khatlon oblast)[5].

As it was mentioned before, low margin in farms-participants in Ferghana oblast is due to high variable costs for agricultural production.

FIGURE 2.24

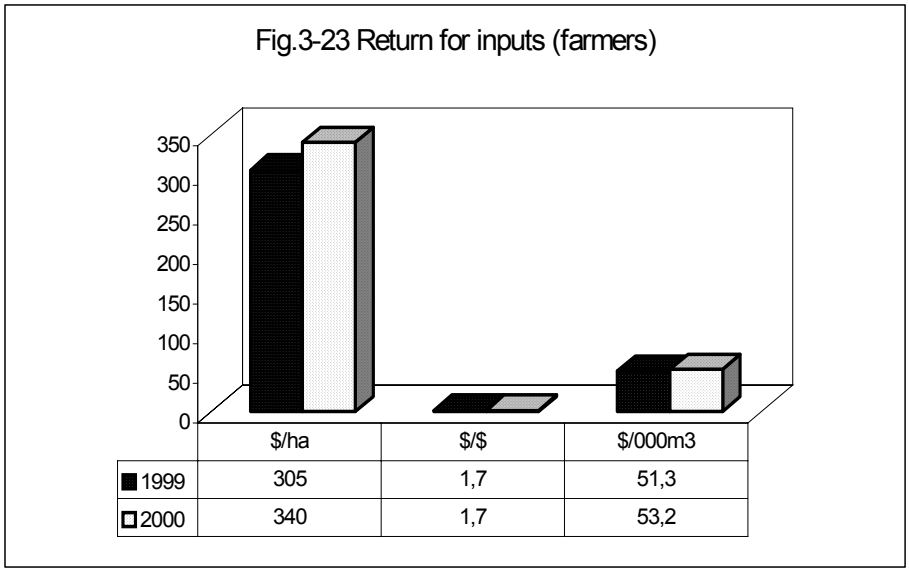
Recovery from production factors (collective farms, cooperatives)



[5] *Recovery from land reduction tendency in private farms requires additional analysis: for instance, in farm "Shuhrat" of Khatlon oblast recovery reduced by 4 times, in farm "Khazh" of Ferghana oblast- by more than 10 times, in farm "Khakullabrui" of Kashkadarya oblast –by 1.6 times.*

FIGURE 2.25

Recovery from production factors (farmers)



Recovery from investments

Recovery from investments is the most important indicator in production planning and organization under transition to market economy. Recovery in monetary dimension per unit investments shows margin per costs ($/$).

Comparing average indicators of recovery from investments over the region with 1999, this indicator reduction can be seen in collective farms and cooperatives on 17% mostly at expense of Kyrgyzstan (from 5.7 to 2.4 $/$ in Jalalabad oblast and from 5.3 to 3.4 $/$ in Osh oblast), where production cost increased. In private farms this indicator remains at the level of 1999, that can witness about better financial arrangement in private farms.

In current situation, and particularly in dry 2000, water is major limiting factor of agricultural production. Water productivity ($/th. m^3) in monetary dimension per unit of irrigation water spent is one of the most important indicators in irrigated agriculture.

Water productivity indicator (average for the region) in 2000 compared with 1999 increased on 42% in collective farms and cooperatives and reduced on 4% in private farms. It is result of simultaneous margin growth and water conservation in collective farms and cooperatives, but margin reduction in private farms.

3.9. Principles of the competition's second stage winners definition

Analyzing participants' activity effectiveness over categories: WUA - collective farms/cooperatives - farmers/dehkan farms, prioritizing has been done according the best use of agricultural production factors.

Then three farms were distinguished from each category over all oblasts of the region achieving the best results in recovery from production factors **(Table 2.14).**

In accordance with recommendations of "Detailed design", a base for winners definition was information from self-monitoring forms and score tables based on this information, prepared by Oblast Expert Councils.

Major factor was growth (for new participants-compared with previous competition; for participants of the first stage-compared with 1999) over such indicators as: yield, irrigation water expenses and profit per unit irrigation water spent. This indicator had the highest weighting in winners definition. This indicator is taken the most important one because under market economy water saving should demonstrate economic effectiveness of rational water use, e.g. balance between water saved and its "repayment" by yield. It requires to pay attention to agrotechnical aspects as well.

To equal the objects of competition, soil bonitet indicators were used.

National monitors assessed results of competition independently. At the final stage, the Regional Monitor group prioritized major indicators and compared assessments made by oblast expert councils with their own. Participant's activity, significance of methods applied for wide dissemination was taken into account as well.

TABLE 2.14

Competition participants: WUA, collective farms/cooperatives, farmers achieving the best indicators

Oblast	Participants of the Competition	Return for land $/ha	Participants of the Competition	Return for investments $/$	Participants of the Competition	Return for water $/000m3
Water Users Associations						
Osh	WUA Sakhy Daryo	746.6	WUA Rakhmat	4.6	WUA Jany Aryk	188.5
	WUA Rakhmat	600.1	WUA Sakhy Daryo	3.6	WUA Sakhy Daryo	94.3
	WUA Jany Aryk	431.9	WUA Jany Aryk	2.2	WUA Rakhmat	81.0
Djalalabad	WUA Kyzyl Ai	568.4	WUA Bulak Suu	3.1	WUA Nooken K	122.9
	WUA Bulak Suu	551.0	WUA Kyzyl Ai	3.1	WUA Kyzyl Ai	102.8
	WUA Nooken K	535.9	WUA Nooken K	2.6	WUA Bulak Suu	64.0
Kolkhozes, cooperatives						
Kzylorda	PC Janajol	398.7	PC Janajol	4.9	PC Janajol	21.0
	PC Shamenov	280.3	FLR agr.firm Shaman	1.5	PC Dostyk and K	14.2
	FLR agr.firm Shaman	265.2	PC Shamenov	1.3	FLR agr.firm Shaman	14.0
South Kazakstan	PC Dostyk	844.7	PC Dostyk	26.5	PC Dostyk	235.9
	PC Ketabai	614.8	PC Ketabai	3.5	PC Ketabai	137.3
	RSCE Komsomol	290.6	RSCE Komsomol	2.5	RSCE Komsomol	21.5
Osh	JSC Uch Kairagach	774.2	JSC Uch Kairagach	3.6	JSC Uch Kairagach	128.6
	JSC Uzgen	395.5	JSC Uzgen	2.5	JSC Uzgen	73.2
Djalalabad	AC Tokntosunov	748.0	AC Tokntosunov	3.8	SSGF A. Yunusov	122.1
	SSGF A. Yunusov	662.2	SSGF A. Yunusov	3.1	SSGF Ak Korgon	116.6
	AC Kench	542.7	AC Kench	2.5	AC Toktosunov	113.9
Sogdy	K-z Rasulov	580.6	AC Digmai	8.4	K-z Rasulov	57.5
	JSC Baimatov	325.5	JSC Baimatov	2.5	JSC Baimatov	37.8
	AC Digmai	284.6	K-z Rasulov	1.9	AC Digmai	31.3
Khatlon	K-z Kulob	900.4	K-z Kulob	4.8	K-z Kulob	83.8
	S-z F. Saidov	848.5	K-z Kommunism	3.0	K-z S. Djumayev	83.6
	K-z S. Djumayev	764.0	S-z F. Saidov	2.7	S-z F. Saidov	67.5
Ferghana	K-z Rakhmatov	191.0	K-z Rakhmatov	0.4	K-z Rakhmatov	53.7
	K-z Al Farghany	100.6	K-z Al Farghany	0.2	K-z Al Farghany	24.0
	K-z A. Navoi	56.5	K-z A. Navoi	0.1	K-z Uzbekiston	20.0
Kashkadarya	K-z Yakshi Omonov	127.3	K-z Chimkurgan	0.3	K-z Yakshi Omonov	24.2
	K-z Amir Timur	71.9	K-z Yakshi Omonov	0.3	K-z M. Ulugbek	23.2
	K-z Uzbekistan	66.5	K-z Uzbekistan	0.3	K-z Chimkurgan	20.3

Oblast	Participants of the Competition	Return for land $/ha	Participants of the Competition	Return for investments $/$	Participants of the Competition	Return for water $/000m3
			Private farms			
Kzylorda	PF Algabas	332.8	FLR Bikmenbet	2.1	PF Jety agayin	19.3
	Pr.F Sapar	305.1	FLR Talptan - 2	1.9	PF Algabas	13.2
	PF Jety agayin	257.6	PF Jety agayin	1.3	PF Jana jol az	11.5
South Kazakstan	Pr.F Janibek	881.3	Pr.F Abildayev	7.7	Pr.F Amerdin Ata	270.7
	Pr.F Abildayev	810.8	Pr.F Rais-baba	6.3	Pr.F Rais -baba	204.1
	Pr.F Amerdin Ata	796.7	Pr.F Janibek	6.2	Pr.F Abildayev	185.3
Osh	Pr.F Kok Jar	1048.7	PF Mungush	5.0	Pr.F Kok Jar	212.3
	PF Mungush	759.9	Pr.F Kok Jar	5.0	PF Mungush	101.6
	Pr.F Maksat	630.9	Pr.F Maksat	3.5	Pr.F Ek Emgek	87.3
Djalalabad	PF Intymak	844.9	PF Intymak	6.6	PF Intymak	174.0
	PF Ala Too	673.7	PF Ala Too	3.5	PF Kulet Ata	142.2
	PF Kyzyl Ata	590.3	PF Kyzyl Ata	2.7	PF Kyzyl Ata	101.8
Sogdy	DF Faravon	376.0	DF Faravon	4.1	DF Samoniyen	54.3
	DF Samonien	258.6	PF Obidjon	2.1	DF Faravon	52.8
	DF Sayed	235.9	DF Sayed	1.9	DF Sayed	39.6
Khatlon	PF Firuz	854.5	PF Firuz	3.2	PF Firuz	89.8
	PF Ismat	258.1	PF Ismat	2.7	PF Ismat	43.9
	PF Shukhrat	226.2	PF Sobir	1.1	PF Safari	15.1
Ferghana	PF Yangi Khayet	611.9	PF Yangi Khayet	2.7	PF Yangi Khayet	95.2
	PF Zarbulok	511.8	PF Zarbulok	1.9	PF Zarbulok	72.7
	PF Kasimkarvon	255.7	PF Otajon	1.0	PF Kasimkarvon	42.0
Кашкадарьинская	PF Khakkalabruy	611.5	PF Khakkalabruy	2.6	PF Khakkalabruy	127.8
	PF Tabbaruk Zamin	477.6	PF Koson	2.0	PF Tabbaruk Zamin	86.8
	PF Ruzimat	428.3	PF Tabbaruk Zamin	1.7	PF Diyer	75.2

Assessing water organizations activity, which do not bear direct responsibility for agricultural production, major evaluation criteria were as follows: effectiveness of water resources management, reduction of organizational losses when conveying water to consumers, irregularity of deficit distribution among water users, water diversion reduction, number of certified water meters. These indicators were assessed in dynamics compared with previous period. Besides, participant's activity in water conservation has been taken into account.

With regard for complex assessments, distribution presented in **Annex E** can be used.

4. WATER USE ISSUES IN SIGHT OF AGRICULTURAL AND WATER SECTOR REFORMING BASED ON MONITORING ASSESSMENT. WUA ESTABLISHING EXPERIENCE

4.1. History of WUA establishing in Central Asia

Reforms in irrigated agriculture of Central Asia were started by paid water use introduction in Kyrgyzstan and Kazakhstan in 1992-1994. In 1995-1996 privatization started with land turnover to farmers for long-term lease (99 years).

Another logic is observed in Tajikistan. Process there has been started from privatization. In 1993-1997 26% of land were distributed among population, in 1998 this share achieved 54%. Paid water use was introduced later compared with Kyrgyzstan and Kazakhstan (in 1996). Agricultural production prices liberalization also has been introduced later (in 1998) after President Decree “About land use right”.

Land privatization character and rate predetermined character and rate of agricultural reforms. In Kyrgyzstan and Kazakhstan privatization has been practically completed, in Tajikistan it still continues.

Privatization processes in Kyrgyzstan and Kazakhstan caused water management structure reforming. Mass separation of large farms in Kyrgyzstan made more difficult rayon water organizations activity in water delivery to water users. Because of that under village authorities (former collective and state farms) governmental structures for water services have been created (“Gidroservice”). Many Gydroservices still exist but some of them are transformed into non-governmental organizations of water users[6].

Similar situation is in Kazakhstan: from the very beginning of land distribution difficulties with water allocation arose. Large agricultural enterprises being owners of on-farm irrigation network used a right of immediate water use. At the same time, conditions were created when peasants tried to get water at expense of these enterprises. Along with water users number increase strict water use became impossible. Instead of 30-40 water users in rayon water organization several thousands appeared.

For example: In Mahtaaral rayon by 01.01.1999 there were 9933 water users including 9486 peasant farms, 416 production cooperatives and 31 state enterprises. Rayon water organization was not able to provide water supply and WUA establishing process has been started inevitably[7].

In Tajikistan and Uzbekistan agricultural reform goes another way and water users organizations (WUO) are not still necessary, so preparatory work is only being started.
In Uzbekistan (Khorezm oblast and Karakalpakstan) next form of WUO exist:

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[6] *In Kyrgyzstan mostly WUA, in Kazakhstan-organizations of water users and other forms exist*
[7] *In Kyzylorda oblast WUOs do not exist and there is not necessity in their establishing*

1. On base of private farms, established instead of abolished non-profitable former collective farms;

2. On base of private farms, established within operating collective farms. Reason for WUO establishing is irregular water allocation with priority of collective farms;

There are not WUO within zone of water conservation competition in Uzbekistan **(Table 2.15)**. There are not enough social-economic premises in Uzbekistan for WUA establishing and local water administrations bear mostly burden of irrigation network O & M.

TABLE 2.15

Water Users Associations – Participants of Stage II of the Competition

Republic	Oblast	Rayon	WUA Name	Area Served (ha)
KAZAKHSTAN	South Kazakhstan	Makhtaaral	ACCWU Rakhat	6000
			WUA Aray	2193
			WUA Makhtaly	3500
KYRGYZSTAN	Djalalabad	Suzak	WUA Bulak Suu	315
		Nooken	WUA Nooken – K	2034
			WUA Kyzyk Ai	2218
	Osh	Karasu	WUA Rakhmat	3229
			WUA Jany Aryk	1000
		Aravan	WUA Sakhi Daryo	1626
		Kadamjay	WUA Kayindy Okhna	514

4.2. WUA objectives and tasks

WUA is voluntary non-commercial specialized democratic structure. It should give charged water services to water users in water delivery and irrigation and drainage network O&M. This should reduce state expenses for those purposes. WUA establishing is based on combination of hydrographic and administrative principles.

Main tasks of WUA are as follows:

- Development of water use plan within command area, its coordination with water system administration;
- Providing with irrigation water farms-water users according to established limits and applications;
- Irrigation-drainage network under WUA administration O & M;
- Water registration in points of intake and outlets to the farms;
- Contract signing with water system administration with definition of each farm contribution depending on water volume, terms of payment, etc.

Network O & M and water registration are not being performed at the moment.

Due to vast territory and unfavorable land reclamation state WUA in Kazakhstan are less active compared with Kyrgyzstan. Nevertheless, certain progress is underway in Kazakhstan as well.

It should be noted, that farm "Rohat" started collectors cleaning. Such cleaning within framework of investment project is much more expensive.

***Kyrgyzstan*.** In spite of some legislative acts preventing WUA establishing, WUA remains a single form of water users organization.

***Kazakhstan*.** Until now WUA were establishing based on Civil Code including all types of associations. According to this Code WUA founders can be only juridical entities. This caused range of issues. After Law "About village cooperation in the Republic of Kazakhstan" acceptance such form as "Village cooperative of water users (VWUC)" became popular.

At the moment WUA "Yernar" has been already re-organized into VWUC "Rahat" (based on canals K-11, K-13); WUA "Aray" also is going to be transformed into VWUC.

It considered more suitable form for credit obtaining on irrigation-drainage network O & M, because water users unit their shares (land, machinery, etc.). But, unfortunately this transformation did not lead to credit obtaining. By the way, VWUC like WUA is non-commercial organization.

Presently, draft law is prepared "About associations of village water users". It is supposed that many shortcomings of previous laws would b eliminated. Kazakh specialists consider that local, rayon and oblast multidisciplinary WUA could be established.

WUO issues in Kazakhstan, from local specialists' point of view, are caused by water infrastructure ownership and the fact, water tariff does not include network repair. Because of that, WUO is busy only by water allocation.

It worth to note, that WUO activity within water conservation competition should be assessed based on indicators developed for water organization. But above problems with water registration at the farm's boundary and low reliability of water supply data make it difficult for monitors to evaluate its activity as water-economic structure.

4.3. Water users association registration

Kyrgyzstan. There is not statutory fund in WUAs surveyed, but this is not an obstacle for registration. It considered too difficult for new WUA to have statutory fund. There are many WUAs in the country not passing registration. For example, in Jalalabad oblast from 29 WUAs 18 ones are not registered; in Osh oblast 23 from 47 WUAs are not registered.

Main reasons for WUAs to be not registered are the following: territorial uncertainty, lack of skilled personnel, lack of finance (5-6 th. som are required), absence of quorum (50% of representatives should be presented at the meeting).

Kazakhstan. In Kazakhstan all WUAs are registered, statutory fund (15-20 th. tenghe) is available.

4.4. Credit

Kyrgyzstan. In Kyrgyzstan project on on-farm irrigation-drainage system rehabilitation has been started. World Bank has allocated long-term soft credit in amount of $20mln. Financing and credit recovery will be performed through WUA (credit to state structure "Gidroservice" is not foreseen).

The problem is that the World Bank is going to finance only sustainable (viable) WUAs (command area should be more than 2000ha); average area is only 100ha.

Credit is allocated for 7 years with re-payment starting since 2001. Size of credit depends on size of WUA.

For example, 2.02 th. som credit is allocated to WUA "Sahiy Daryo" (1.62 th. ha), WUA "Rahmat" (3.2 th. ha) – twice more. At expense of credit needed equipment (computers, cars, mobile phones) is procured.

Kazakhstan. In Mahtaaral rayon the project on irrigation-drainage network is being implemented, tender for which has been won by Bulgarian company. Analysis shows that water users mostly recognized that water delivery should be paid, but they are not ready yet to spend money for land reclamation.

Both in Kyrgyzstan and Kazakhstan water users need long-term credits for machinery purchase.

4.5. WUA staff and members

Kyrgyzstan. WUA staff and, first of all, number of mirabs (responsible for water allocation) depends, as a rule, on command area, irrigation and drainage network length and number of WUA's members.

For example, WUA "Kyzyl Ai" staff is as follow: chairman, accountant, secretary, chief civil engineer, technician, mirabs (7 persons), agricultural machinery drivers (3 persons).

In WUA "Sahiy Daryo" 18 mirabs work, in WUA "Rahmat"-11 mirabs, in spite of fact that command area of the first WUA is significantly less. Due to further separation of large farms in Aravan rayon WUA activity became more complicated, in result of this number of mirabs was increased from 12 to 18.

WUA members are divided into permanent and provisional (99%). Provisional members are leaseholders working under contract with WUA and village authority for land and water use from state fund.

In WUA "Kyzyl Ai" there are 12 ayils (villages). In each village there are 150 water users. Communication is absent. Information exchange is executed during daily meetings and through dispatch point. Horses are used as a transport mean.

Kazakhstan. According to rule, WUA's chairman can be any person even not having special education. Due to lack of finance WUA staff is strictly limited.

One of the WUAs has 25 cooperatives and more than 320 peasant farms as members. Command area is 5034.3ha, main canals length is 31.8km and central collector-10km. WUA;s staff consists of 6 persons: chairman, accountant and 4 field collaborates.

Similar situation is typical for all other WUAs. Limited and poorly trained personnel is not able to provide proper services.

4.6. Criteria of WUA functioning sustainability

According to Kyrgyz specialists' opinion, main criteria of WUA functioning sustainability are as follows:

- Command area (according to foreign experts it should be more than 2th.ha);
- Timely payment to rayon water organization;
- Volume of repair-operation works;
- Relations with water users (complaints for unsatisfactory services);
- Agricultural production growth;
- Timely salary payment to staff;
- Personnel constancy.

Coming out from these criteria, there are too little sustainable WUAs.

4.7. WUA budget

WUA sources of income can be members' charges for water services, bank interests, donations and grants from state and foreign sources. Sometimes, though WUAs are non-commercial organizations and have privileges from state, fiscal entities do not take this into account.

To avoid VAT WUA "Kyzyl Ai" chairman proposed to replace water services charges by membership fees. Membership fee is established as 50 som/ha. At expense of these fees water delivery and irrigation-drainage network repair are executed.

From water services charges WUAs in Kyrgyzstan pay: 38% to state budget (social fund), 2% to local budget. Rest should be spent for staff salary, fuel, electric energy, etc. Besides, income tax is paid from salary.

4.8. Irrigation systems operation

In connection with reforms in agriculture problem of reliable water registration became more complicated. Particularly WUAs are in hard situation.

In Kazakhstan water supply to small private farms is normally calculated; in Kyrgyzstan stationary gauging posts construction is planned (one for several farms). Where there are not stationary water meters, portable Chipoletti weirs are used: ВЧ-50 for technicians and ВЧ-25 for mirabs. Their accuracy is low and because of that weir production is started in Bishkek and Osh (weir price is 1000 som).

Water registration is also amplified.

WUA "Kyzyl-Ai" chairman proposed special forms of water registration for mirabs. He plans to modify these forms to get information about crop water consumption. Technicians have own forms for water transfer at WUA boundary.

4.9. Land reclamation

As it was expected, with reforms starting land reclamation issues were forgotten and collector-drainage network (especially inter-farm one under WUA command) state was sharply aggravated. WUAs have no own finance and water users are not ready to take credits for land reclamation. Where WUA is absent and area is small, reclamation issues are most difficult. These issues are particularly critical for Kazakhstan.

Kazakhstan. Analysis of situation in South Kazakhstan (Mahtaaral rayon) shows land reclamation state aggravation. Since 1992 vertical drainage system is out of operation due to lack of finance. For the same reason leaching is done only on 50% of land.

There are legal shortcomings as well. Rayon water organization provides water for leaching if 70% of land are prepared. In opposite case unproductive water losses will be very high. Thus, farmers depend not only on own financial state, but as well on their neighbors' one.

Before 1991 leaching was started in December-January. Due to lack of finance and machinery it is started during last years in February.

As positive fact can be noted, that during non-growing season 1999-2000 compared with 1998-1999 leaching was started before February and covered bigger area.

In 1998-1999 many farmers did not do leaching being afraid that ground would not dry up to sowing. But in 1999-2000 farmers, using experience of 1998-1999, when farmers doing leaching got higher yield, understood usefulness of leaching.

It worth to note, that leaching technique remains poor: checks are big; water from one check runs to adjacent one and is released from last check to collector. Water

depth achieves sometime 60cm. Field of 30-40 ha is irrigated for 5-7 days and it is sucked during 5-7 days. Leaching norm is 5000 m^3 /ha (vegetation irrigation norm is 2000-3000 m^3 /ha).

In Mahtaaral rayon project on irrigation-drainage network rehabilitation is underway; construction is executed by Bulgarian company. Project foresees collectors cleaning, irrigation network and vertical drainage reconstruction. In spring 2000 work was stopped due to lack of mechanism for investment obtaining and return. From the very beginning it was supposed that all expenses will be covered by water users (WUA members), but it was revealed that not all farmers knew about that. And now, when question is considered how to return investments, farmers begun to worry. Situation has been aggravated by the fact that collectors cleaning was performed during leaching and collector's slopes were heaving.

Farm "Rohat" (former WUA "Ernar") independently started collectors cleaning. *There is agreement with water users and fathers' council that they will allocate 350-400 tenghe/ha for this work.*

4.10. Interrelations between rayvodkhoz and WUA

Between rayvodkhoz and WUA contract on water delivery is concluded. According to this contract, rayvodkhoz is not responsible for water delivery failure if it is caused by water deficit or water structures destruction by sel. Rayvodkhoz is interested in WUA and supports its establishing. But because of water fees irregularly paid by water users, there are some problems between WUA and rayvodkhoz.

Kyrgyzstan. By start of reforms rayvodkhoz dealt with representatives of governmental structures "Gidroservice" which collected fees for water services, but not with water users. This practice was not proved and "Gidroservices" were transformed in WUAs.

There are contradictions between WUA "Kyzyl Ai" and Bozor-Korgan rayvodkhoz. Rayvodkhoz does not take into account water losses in rayon irrigation network, e.g. water registration is made not on the WUA's boundary. If, for example, irrigation norm for cotton is 8300 m^3/ha on WUA's boundary, WUA should pay for 11220 m^3/ha (including losses in inter-farm irrigation network).

Kazakhstan. In Mahtaaral rayon of Kazakhstan there is conflict situation between rayvodkhoz and WUAs.

WUAs, which take water immediately from interstate canal Dostyk (former main canal named by Kirov), consider that rayvodkhoz practically does not provide any services to them. In accordance with provision of State property Committee "About inter-farm irrigatioopn systems transfer to water users associations", number of WUAs taking water immediately from Dostyk canal increased (canal K-15 is transferred and canal K-13 is planned to be transferred). Because of that conflict between rayvodkhoz and WUAs can become stronger.

This transfer should have positive consequences for water allocation accuracy, canal operation effectiveness, water allocation equity (WUA is democratic body under water users control). This should also have positive financial consequences because water services can be reduced. It should be positive for rayvodkhoz as well because it can focus its efforts on main canals operation efficiency. One of concepts in Kazakhstan rayvodkhoz should be transformed into rayon WUA.

4.11. WUA and water conservation

WUA is non-commercial democratic organization of water users really interested in rational water use. Such voluntary association of water users allows them to participate in water resources management processes coming out from their requirements for irrigation. In practice rational water use is not always possible, particularly in cases when WUA acts as rayvodkhoz's subdivision and when WUA chairman considers it as his own commercial company.

4.12. Positive and negative aspects of agricultural and water sector reforming and their impact on WUA

Numerous unsuccessful experiments of water sector reforming through paid water use in Soviet time showed, that without market reforms in agriculture it is difficult to achieve success in water sector reforming.

All four Central-Asian countries participating in water conservation competition after independence gaining selected own ways of agricultural and water sector reforms. Kazakhstan and Kyrgyzstan used "shock therapy", e.g. reforming outstripped necessary legal base preparation. In Tajikistan and Uzbekistan reforming is going another way. In Tajikistan paid water use was introduced preliminary along with liberalization of agricultural production trade and legal base preparation. Uzbekistan selected even more gradual reforming. Restructuring processes were started on background of 50-65% of state order for agricultural production and absence of paid water use, but with strict water supply limitation and financing most part of former on-farm irrigation and drainage network O & M from state budget.

In Kyrgyzstan and Kazakhstan reforms firstly have led to agricultural production decline and it was not so deep because of labor, machinery, fuel, fertilizers and even production itself overflow from adjacent republic.

Most important part of reforms in Kyrgyzstan, Tajikistan and Kazakhstan was, in opinion of local and foreign specialists, freedom given to agricultural producer.

In Kazakhstan this freedom had also negative consequences.

For example, in Mahtaaral rayon more than 95% of irrigated area is covered by cotton. Optimal structure of irrigated lands with regard for crop rotation remains only in several cooperatives ("Dostyk", Mahtaaaral rayon; "Farhad", Turkestan rayon). In Shardara traditionally rice growing rayon cotton prevails now.

Interest to cotton growing is caused by producers financing from ginneries at expense of future export supplies. It is known, that local authorities insist on rice share increase but without prepayment producers are not able to grow rice.

In result of reforms system of agricultural production and water sector management has been strongly weakened. Full stopping of financing from state budget, problems with water charges collection and sometime groundless taxation put water sector in hard position.

More favorable is the model of gradual state support reduction accepted in Kyrgyzstan.

In Tajikistan water sector management is very complicated. The reasons for this situation are the same as mentioned above.

If to account that 70% of lands in Sugd oblast of Tajikistan are irrigated by water lift and financial means for equipment are very limited, many irrigated areas have bad perspective.

In Kyrgyzstan and Kazakhstan model of mass free land transfer is selected. In result of this lot of small farms appeared that made difficult agricultural production and water use. Mostly only lands were distributed among the farmers, livestock and machinery were given to few. This situation is aggravated by the fact, that due to unemployment big number of workers was forced to cultivate crops instead of cattle breeding which they used to be occupied with.

Along with farms separation, process of cooperation is underway which is hindered by lack of machinery and agro-service. Market reforms in agriculture are hindered by absence of soft long-term credits but to get credit is very difficult for most farmers.

Agricultural reform strategy, accepted in Kyrgyzstan and Kazakhstan, caused water sector reorganization and created base for solution tasks of reforming.

In result of reforms functions of oblvodkhozs changed: new structures (WUA) were created, rayvodkhozs became self-financing. It is impossible to imagine water management at lower level in Kyrgyzstan and Kazakhstan without WUA.

During several years WUAs and rayvodkhozs provide paid services to water users. Water fees collection is improving with time.

In Kyrgyzstan the state continues partially finance rayvodkhozs' activity, in Kazakhstan and Tajikistan such assistance is absent. Financing stopping led to more unsustainable water management in Kazakhstan compared with Kyrgyzstan. Consequence of this is low water use level and reclamation systems and irrigated lands deterioration.

WUA issues are as follow:

- They have no own machinery (as a rule, it is leased);
- Lack of water-meters. Water distribution at the farm boundary is executed approximately or by potable weirs.
- WUA leaders often have no necessary qualification;
- Weak legal support (investigation magistrate often does not pay attention to water use rules violation, revealed by WUA);
- Small farms creation led to WUA establishing but over-separation makes their normal functioning impossible.

It is expedient to establish WUA at the initial stage of reforming because they can manage both agriculture production and water. French experience in WUA functioning is very useful: WUA leader is elected president and technical management is fulfilled be hired manager.

WUA financial state depends on water users solvency. Water users solvency in Kazakhstan and Kyrgyzstan is hindered by many mediators having most part of profit. Mediators are private firms and state should play more active role in restriction of their profit.

Taking into account necessity of WUA support and limited own financial means, governments attract foreign investments in on-farm and inter-farm irrigation-drainage network rehabilitation. It is understood, that water conservation problem can not be solved without investments including foreign ones. But experience of “Bulgarian project” in Mahtaaral rayon shows, that strategy and tactics of investments attraction should be properly thought about with water users participation during all stages of discussion. It worth to note, that water users are mostly interested in soft long-term credits to purchase agricultural machinery.

Irrigation fund in Kyrgyzstan if transferred to WUA free of charge, in Kazakhstan it can be privatized through tender or auction but few people will to purchase it.

There are few sustainable WUAs and their role is not so great, but it is understandable on background of production decline. Nevertheless, according to opinion of local specialists, new approaches are laid in water sector management **(Table 2.16)**.

TABLE 2.16

Potential advantages and shortcomings of existing WUAs

Potential advantages	Disadvantages of existing WUAs	Reasons for disadvantages
1. WUA is juridical and financially independent organization, which represents the interests of water users economically interested in rational water use and water savings. 2. WUA is non commercial structure, and due to that fact it has the right for privileged regime of taxation and it should spend its profit for the development of WUA. 3. WUA is democratic organization, which is able to improve water allocation, efficiency of investments and to provide direct participation of water users in the decisions on water resources management.	1. Not enough equipment of irrigation network with water measuring facilities at the farm boundaries. 2. Not enough equipment with means of communication, vehicles and machinery for maintenance of HAS and structures. 3. Not enough quality of water allocation. 4. Not enough high level of personnel skills. 5. Very few members of staff. 6. Many of WUAs have no state registration, i.e. they are not juridical persons (Kyrgyzstan). 7. Not enough level of farmers training for independent irrigated farming.	**Financial** 1. Low rate of fees for water services collection caused by weal financial conditions of the majority of water users. 2. Limited access to privileged loans. 3. Taxation with VAT. **Organisational** 1. Numerous number of water users (physical persons) with relatively small irrigated areas. 2. Low level of cooperation in agriculture. 3. Non civilized interference of local authorities in water resources management. **Technical** 1. Hydraulic – ameliorative systems need rehabilitation. 2. Irrigated lands need land reclamation (Kazakhstan). **Legal** 1. Legislative acts related to WUAs need improvement in terms of insuring right for water and creation of market of rights for water and land. 2. Weak legal support by juridical bodies in the struggle of WUA against break up of water discipline.

Positive consequences of agricultural and water reforms in Kyrgyzstan are assessed by local specialists as follow:

- water consumption reduction;
- water lift irrigation area reduction;
- cropping pattern change (increased share of less water consuming crops: grain, sunflower);
- land reclamation state improvement somewhere due to water consumption reduction.

Along with this, negative consequences are the following:

- crop rotation was fully abolished, that reduces land fertility;
- technical state of hydro-reclamation systems is deteriorated.

Role of the state in agriculture civilized management is very important and in sight of this favorable situation it seems occurs in Kyrgyzstan, but even there the state is not active enough in producers protection from numerous mediators preventing peasants to develop themselves.

At the same time, is evident, that only sustainable functioning farmers and cooperatives can take responsibility for irrigation and drainage network O & M and modernization needed for effective water use and water conservation.

5. PROPOSALS ON WATER RESOURCES RATIONAL UTILIZATION METHODS IMPROVEMENT

5.1. Water resources rational utilization methods improvement

Under transition to market economy farmers, dehkan farms, shirkats present certain requirements to water consumption depending on crop pattern. These requirements management at irrigation system and river basin level is executed by state and inter-state water bodies.

Two principal provisions hinder perfection of rational water use and conservation measures in wide scale:

- Measures on water conservation connected with irrigation systems reconstruction and modernization require investments of 1.0-1.4 $\$/m^3$ of saved water;
- Water users from private, dehkan farms and shirkats, particularly where paid water use has not been introduced yet, are not interested in water conservation because most ecological and social-economic issues are faced by society as a whole.

Therefore, problems of on-farm and inter-farm irrigation systems' efficiency improvement, irrigation technique and technologies amplification, field leveling improvement, partial reconstruction of hydro-reclamation systems can be solved by the state investments and soft credits.

Taking into account important role of irrigated agriculture in the economy of the region's countries, it is necessary to create a system of support to agricultural and water sector directed to irrigated lands and irrigation water productivity increase.

As A-2 sub-component's experience shows, water users from low water availability irrigation systems and densely populated regions with high culture of irrigated farming are mostly interested in water saving. Main incentive for water saving is the way how irrigated farming is carried out and traditional attitude to water. In these zones water use efficiency improvement is possible according to next scenario:

- At the first stage minimal support from the state to water conservation measures initiated by water users is needed (successive irrigation; mulching preventing excessive physical evaporation; multi-tier irrigation in short furrows; cumulative irrigation and water rotation among irrigated plots; draught-resistant crops cultivation, etc.).
- At the second stage (under transition to paid water use) it is necessary to equip irrigation systems with water-meters (state allocates materials, equipment and metrological provision and farms give labor) at farm and irrigated plot level.
- At the third stage (under paid water use) state (with water users participation) starts irrigation systems reconstruction.

- At the fourth stage water users, interested in O$M cost reduction under state support (soft credits, equipment procurement) start transition to advanced irrigation methods and technologies.

In new development zones it is necessary to carry out preliminary organizational-technical measures on farmers training in water rational use and conservation.

During the period of transition to market economy the state is interested in rational water use because of water delivery from source to farm cost reduction. These expenses before paid water use introduction is fully covered from state budget. On consequent stages, irrigation system O & M cost partially is taken by water users.

Along with small farms creating and former on-farm network transforming into inter-farm one, necessity arises for intermediate link-water users associations as mediators presenting interests of water users in governmental bodies. Governmental bodies' functions are concentrated on water resources planning and management, main canals O & M.

WUA legal base is best developed in Kyrgyzstan. Nevertheless, multitude of small farms there creates difficulties as well. With regard to this, legal documents development is necessary taking into account specific features of irrigated agriculture of natural-climatic zones and existing land and water laws **(Table 2.17)**.

TABLE 2.17

Proposed findings for ground and introduction of rational water use and conservation methods

Necessary developments for grounding and introduction of the rational water usage methods	Results
1. Development of recommendations for operation of water systems in conditions of market economy. I stage – Development of a concept for operation of water systems in conditions of market economy. II stage – Development of organizational and functional structures for operation of water systems on a different management levels. III stage – Development of normative documentation on pilot production working-through of operation forms on typical water systems. IV stage - Introduction if irrigated agriculture into practice.	Normative technical documentation on operation of water systems in conditions of market economy.
2. Development of organizational, economic and legal systems for functioning of water complex during transition to chargeable water usage. I stage – Feasibility study for transition of water complex to chargeable water usage (Turkmenistan, Uzbekistan). II stage – Development of organizational, economic and legal measures for functioning of water complex in conditions of chargeable water usage. III stage – Development of typical normative-legal documentation on mechanism of chargeable water usage implementation on pilot production water systems. IV stage - Introduction if irrigated agriculture into practice.	Normative-technical documentation (organizational, economic, legal) on mechanism of water complex functioning in conditions of chargeable water usage.

Necessary developments for grounding and introduction of the rational water usage methods	Results
3. Development of organizational-technical measures for water saving, facilitating application of perfect irrigation technologies for cotton growing in various natural climatic zones of the Aral Sea basin, in conditions of market relations development in water economy and agriculture. I stage – Development of advisable zoning for irrigated territories in natural climatic zones, improvement of irrigation technologies concerning the water saving issues. II stage – Development of design documentation for creation of new types of perfect irrigation technique, with orientation toward its application on the basis of local materials and existing production capacities. III stage – Development of demonstration irrigation systems – basic systems for training farmers on the rational nature usage methods. IV stage – Transition to a large-scale introduction of perfect irrigation technologies into the practice.	Normative-technical documentation (organizational, economic, legal) on mechanism of large-scale introduction of perfect irrigation technologies into the practice.

5.2. Proposals on practical interaction between competition participants, oblast expert councils, managers and monitors improvement

There is necessity to carry out 1-2 day workshops in each oblast for competition participants with invitation of oblast expert councils, managers and national monitors, sub-component A-1 and component B national experts. Goal of these workshops is to familiarize all participants with the best experience gained during competition, discussions and consultations on matter.

Without doubt, competition results depend on managers and monitors interaction and collaboration, that was demonstrated by two first stages.

Managers and monitors' objectives and tasks are described in detail within framework of "Detailed design". Major task for manager is to provide competition's organizational arrangement and participants' self-monitoring. Major task for monitor is analysis and assessment of competition participants activity effectiveness and revealing the best approaches to water conservation and irrigation water productivity increase. It is expedient that during new season of competition monitors would concentrate themselves on the most interesting participants' initiatives.

Due to remoteness of competition's objects, it is expedient to include oblast monitors from highly qualified local specialists. By this interaction with national monitors will be improved and latter can focus on analysis and assessment of tendencies and development of recommendations.

This offer will require some re-distribution and additional financial means as well as support from national coordinators.

ANNEX A

LOCATION OF THE OBJECTS OF THE COMPETITION "WATER SAVING"

Republic	Oblast	Rayon	Water Managing Organisations			
			1999		2000	
			Name	■	Name	■
KAZAKHSTAN	Kzylorda	Shieli	Shieli DWMS	1	Shieli DWMS	1
		Janakurgan	Janakurgan DWMS	2	Janakurgan DWMS	2
		Syrdarya	Kzylorda DWMS	3	Kzylorda DWMS	3
		*			Syrdarya DWMS	4
		Karmakchi			Karmakchi DWMS	5
		Jalagash			Jalagash DWMS	6
				3		6
	South Kazakstan	Makhtaaral	Makhtaaral DWMS	4	Makhtaaral DWMS	7
		Turkestan	Turkestan DWMS	5	Turkestan DWMS	8
		Shardara	Kyzylkum DWMS	6	Kyzylkum DWMS	9
		Ordabas				
		Sairam				
				3		3
KYRGYZSTAN	Djalalabad	Alabuka	Alabuka RDWM	7	Alabuka RDWM	10
		Bazar - Korgon	Bazar - Korgon RDWM	8		
		Aksy	Aksy RDWM	9	Aksy RDWM	11
		Suzak			Suzak RDWM	12
		Nooken			Nooken RDWM	13
		Toktogul				
				3		4
	Osh	Karasu	Karasu RDWM	10	Karasu RDWM	14
		Nookat	Nookat RDWM	11	Nookat RDWM	
		Aravan	Aravan RDWM	12	Aravan RDWM	15
		Kadamjay				
		Uzgen			Uzgen RDWM	16
		Kara - Kuljan				
				3		3
TADJIKISTAN	Sugd	Kanibadam	Kanibadam PROA	14	Kanibadam WMA	17
		Asht	Asht PROA №2	15		
		Djabbar Rasulov	Djabbar Rasulov WMA	16	Djabbar Rasulov WMA	18
		Khodjent				
		Isfara				
		Zafarabad				
		Bobojan Gafurov			Bobojan Gafurov WMA	19
				3		2
	Khatlon	Bokhtar	Bokhtar HAPROA	17	Bokhtar HAPROA	20
		Khodjamaston	OD Shurabad IN	18	OD Shurabad IN	21
		Vaksh			OD Vaksh IN	22
		Gozimalik				
		Dangara	OD Dangara IN	19		
		Sarband				
		Kolkhozabad				
		Djililkul				
				3		3

Republic	Oblast	Rayon	Water Managing Organisations			
			1999		2000	
			Name	■	Name	■
UZBEKISTAN	Ferghana	Kuva	Kuva RDAWM	20	Kuva RDWM	23
		Oltiaryk	Oltiaryk RDAWM	21	OltiarykRDAWM	24
		Besharyk	Besharyk RDAWM	22	Besharyk RDAWM	25
				3		3
	Kashkadarya	Nishan	Nishan RDAWM	23		
		Kamyshin	Kamyshin RDAWM	24	Kamyshin RDAWM	26
		Shakhrizjabz	Shakhrizjabz r-n MCDM	25	Shakhrizjabz r-n MCDM	27
		Karshi			Karshi RDAWM	28
		Kasbi				
		Kasan				
				3		3
				25		**29**

Republic	Oblast	Rayon	Water Users Associations			
			1999		2000	
			Name	▲	Name	▲
KAZAKHSTAN	Kzylorda	Shieli				
		Janakorgan				
		Kzylorda				
		Kazalinsk				
		Djalagash				
			0	0	0	0
	South Kazakstan	Makhtaaral	WUA "Ernar"	1	APC "Rakhat"	1
		*	WUA"Aray	2	WUA "Aray"	2
		*	WUA "Jilkeldy"	3		
		*	WUA "Syrdarya"	4		
		Turkestan				
		Shardara				
		Ordabas				
		Sayram				
			0	4	0	2
KYRGYZSTAN	Djalalabad	Alabuka				
		Bazar - Korgon	WUA "Kyzyl-Ai"	5		
		Aksy				
		Suzak			WUA "Bulak Suu"	3
		Nooken	WUA "Aral Sai"	6	WUA "Nooken-K"	4
		*			WUA "Kyzyl-Ai"	5
		Toktogul				
			0	2	0	3
	Osh	Karasu	WUA "Rakhmat"	7	WUA "Rakhmat"	6
		*	WUA "Jany Aryk"	8	WUA "Jany Aryk"	7
		*	WUA " Uch Kairagach"	9		

Republic	Oblast	Rayon	Water Users Associations			
			1999		2000	
			Name	▲	Name	▲
		Nookat				
		Aravan	WUA "Sakhy Darya"	10	WUA " Sakhy Darya"	8
		Kadamjay	WUA "Kaindy Okhna"	11	WUA "Kaindy Okhna"	9
		*	WUA "AkSuu Kholmion"	12		
		Uzgen				
		Kara Kuldjin				
			0	6	0	4
TADJIKISTAN	Sugd	Nauss				
		Kanibadam				
		Djabbar Rasulov				
		Khodjent				
		Isfara				
		Zafarabad				
			0	0	0	0
	Khatlon	Bokhtar				
		Khodjamaston				
		Vaksh				
		Gozimalik				
		Dangara				
		Sarband				
		Kolkhozabad				
		Djililkul				
			0	0	0	0
UZBEKISTAN	Ferghana	Kuva				
		Oltiaryk				
		Besharyk				
			0	0	0	0
	Kashkadarya	Nishan				
		Kamyshin				
		Shakhrizjabz				
		Karshi				
		Kasbi				
		Kasan				
			0	0	0	0
			0	**12**	0	**9**

Republic	Oblast	Rayon	Kolkhozes, associations, cooperatives			
			1999		2000	
			Name	•	Name	•
KAZAKHSTAN	Kzylorda	Shieli	FLR Akmaya - 2	1	FLR Akmaya - 2	1
		*	FLR Akniyat	2	FLR Gigant	2
		Janakurgan			S/f Togusken	3
		Kzylorda				
		Karmakchi			RPC Jonajol	4
		*			PC Dostyk &C	5
		Syrdarya			FLR Shagan	6
		*			FLR N.Ilyasov	7
		Jalagash			PC Shamenov	8
			0	2	0	8
	South Kazakstan	Makhtaaral			PC Dostyk &C	9
		*			PC Ketebai	10
		Turkestan	PC Ikan	1	PC Farkhad	11
		*			PC Koktondy Ata	12
		Shardara	RSCE Komsomol	2	RSCE Komsomol	13
		*	SCE Jaysan	3	SCE Jaysan	14
		Ordabas				
		Sayram			PC Yassavi	
			0	3	0	6
KYRGYZSTAN	Djalalabad	Alabuka	SSGF Ak Korgon	4	SSGF Ak Korgon	15
		Bazar Korgon				
		Aksy				
		Suzak	AC Akykat	5	AC Akykat	16
		*	AC Toktosunov	6	AC Toktosunov	17
		*			SSGF A.Yunusov	18
		Nooken	AC Kench	7	AC Kench	19
		Toktogul			Ps.C Chychkan	20
			0	4	0	6
	Osh	Karasu			JSC Uch Kairagach	21
		Nookat	AC Itymak	8	Ps.Saliyeva	
		*	Ps.C Saliyeva	9		
		Aravan				
		Kadamjai				
		Uzgen			JSC Bee Brooder	22
		Karakuljin				
			0	2	0	2
TADJIKISTAN TADJIKISTAN	Sugd	Kanibadam	JSC Iram	10	Jsc Iram	23
		*			JSC Boimatov	24
		Djabbar Rasulov			K-z Samadov	
		*			AC Digmay	25
		Khodjent	K-z Bobokolonov	11		
		*	JSC A. Rakhimboyev	12		

Republic	Oblast	Rayon	Kolkhozes, associations, cooperatives			
			1999		2000	
			Name	•	Name	•
		Isfara	K-z Z. Khasanov	13		
		Zafarabad				
		B. Gafurov			JSC A. Rakhimboyev	26
		*			JSC Jumayev	27
		*			K-z Rasulov	28
		Matchi			AC Zarifiyen	
			0	4	0	6
	Khatlon	Bokhtar	K-z Kommunism	14	K-z Kommunism	29
		*	S-z F. Saidov	15	S-z F. Saidov	30
		Khodjamaston	K-z Lenin	16	K-z Lenin	31
		*	K-z Komsomol	17	K-z Komsomol	32
		Vaksh	K-z Kulob	18	K-z Kulob	33
		*	K-z Leningrad	19	K-z Leningrad	34
		Gozimalik	S-z Bobojonov	20	S-z Bobojonov	35
		Dangara				
		Sarband	K-z R. Odinayev	21	K-z R.Odinayev	36
		Kolkhozabad	K-z S. Jumayev	22	K-z S. Jumayev	37
		*			K-z Lenin	38
		Djililkul	K-z E. Sattorov	23		
			0	10	0	
UZBEKISTAN	Ferghana	Kuva	K-z Navoi	24	K-z Navoi	39
		*	K-z Khakikat	25	K-z Khakikat	40
		*	K-z Dekhkanabad	26	K-z Rakhmatov	41
		Oltiarik	K-z Kuziboyev	27	K-z Al Fargoni *)	42
		*	K-z Poloson	28	K-z Navoi	43
		*	K-z Navoi	29		
		Besharyk	K-z Rapkon	30	K-z Rapkon	44
		*	K-z Namuna	31	K-z Dustlik	45
		*	K-z Uzbekiston	32	K-z Uzbekiston	46
			0	9	0	8
	Kashkadarya	Nishan	K-z Turkmeniston	33		
		*	K-z Dustlik	34		
		Kamashi	K-z Karabag	35	K-z Karabag	47
		*	K-z Tukbai	36	K-z Chimkurgan	48
		*	K-z Gishtli	37		
		Shakhrizyabz	K-z Uzbekiston	38	K-z Ulugbek	49
		*			K-z Amir Timur	50
		*			K-z Uzbekistan	51
		Karshi			K-z Yakshi Omonov	52
		Kasbi	K-z Kh. Khujakulov	39	K-z Kh Khujakulov	53
		Kasan				
			0	7	0	7
				39		**53**

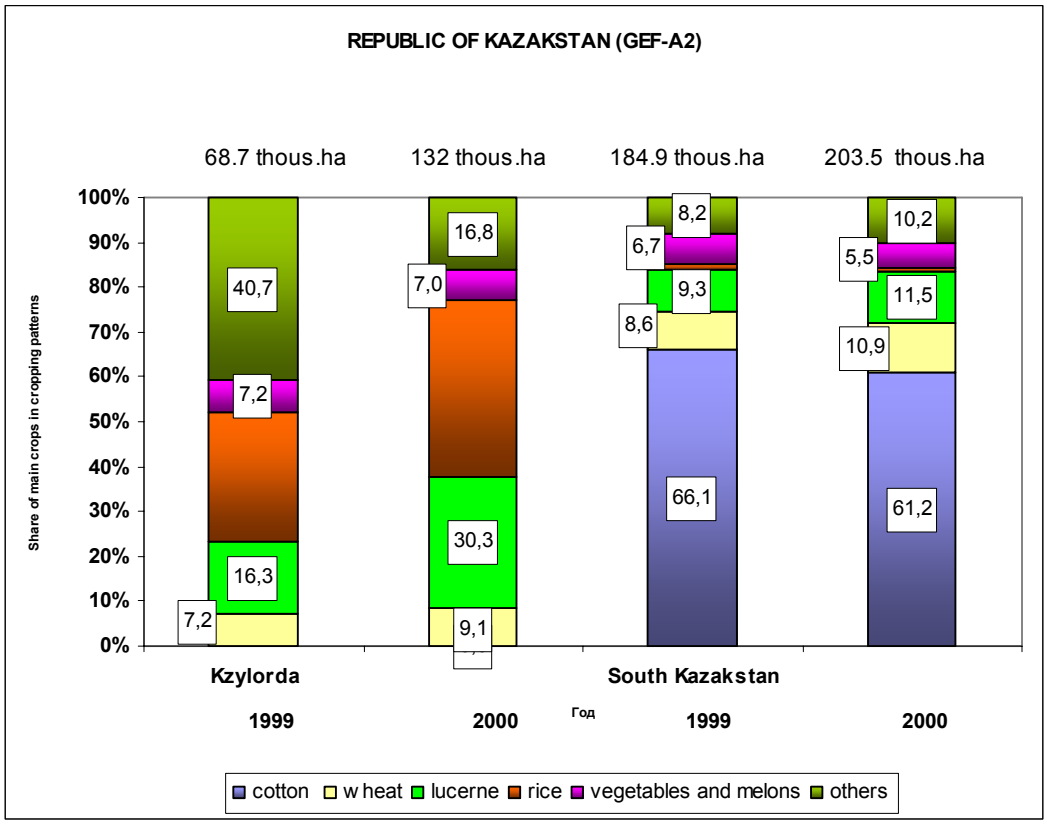
Republic	Oblast	Rayon	Private Farms			
			1999		2000	
			Name	○	Name	○
KAZAKHSTAN	Kzylorda	Shieli			Ps.F Jety agayin	1
		*			Ps.F Izgilik	2
		*			Ps.F Maksat	3
		*			Ps.F Akniyet	4
		*			PF Sapar-во	5
		*			FLR Nartaya	6
		*			FLR Bikmenbet	7
		*			FLR Talaptan - 2	8
		Janakorgan			Ps.F Jana Jol Az	9
		*			Ps.F Tyrlibek	10
		*			Ps.F Juldyz	11
		Jalagash			Ps.F Algabas	12
			0	0	0	12
	South Kazakstan	Makhtaaral	PF Abyldayev	1	PR Abildayev	13
		*	PF Sattorov	2		
		Turkestan	PF Amerdin Ata	3	PF Amerdin Ata	14
		*	PF Koshkar Ata	4	PF Koshkar Ata	15
		*			PF Rais Baba	16
		Shardara	PF Janibek		PF Janibek	17
		*			PF Asem	18
		Ordabas	Ps.F Asan	5	Ps.F Asan	
		*	Ps.F Kultogan	6	Ps.F Kultogan	
		Sayram				
			0	6	0	6
KYRGYZSTAN	Djalalabad	Alabuka	Ps.F Jenish	7	Ps.F Jenish	19
		*	Ps.F Bakyt&C	8	Ps.F Kulet Ata	20
		*	Ps.F Chadek	9	Ps.F Naimetov	21
		*	Ps.F Manas	10		
		*	Ps.F Beshim	11		
		Bazar Korgon	Ps.F Alatoo	12	Ps.F Alatoo	22
		*	Ps.F Kyzyl Ata	13	Ps.F Kyzyl Ata	23
		Aksy	Ps.F Intymak	14	Ps.F Intymak	24
		Suzak	Ps.F Bakyt	15	Ps.F Ak Tilek	25
		*			Ps.F Jigach Korgon	26
		*			Ps.F Jaichi	27
		Nooken				
		Toktogul	Ps.F Chychkan	16		
			0	10	0	9
	Osh	Karasu	Ps.F Aidar	17	Ps.F Mungush	28
		*	Ps.F Mungush	18	PF Maksat	29
		*	PF Maksat	19		
		Nookat				
		Aravan	PF Ogalik	20	PF Ogalik	30

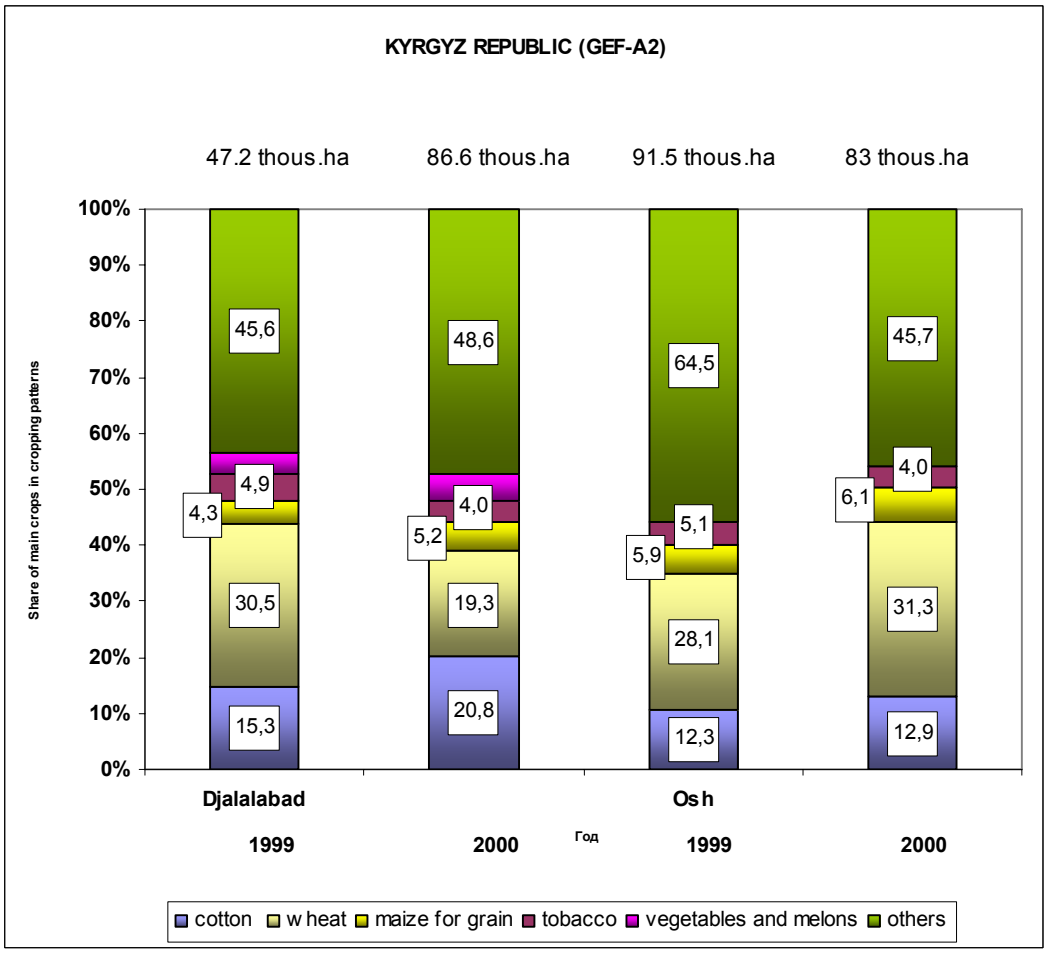
Republic	Oblast	Rayon	Private Farms			
			1999		2000	
			Name	○	Name	○
		*				
		Kadamjai	PF Kyzyl Dobo	21		
		*	PF Mamat Toko	22		
		Uzgen	PF Shabdan	23	PF Shabdan	31
		*	PF Ak Emgek	24	PF Ak Emgek	32
		Kara Kuljan			PF Kok Jar	33
			0	8	0	5
TADJIKISTAN	Sugd	Kanibadam			PF Gafurov	34
		*			DF Faravon	35
		*			PF Samonien	36
		Djabbar Rasulov			PF Sayed	37
		*			DF Zarzamin	
		Khodjent				
		Isfara				
		Zafarabad	DF Davronien	25	DF Davronien	38
		*			PF Obijon	39
		*			PF Yusufi	
		Matchi			PF Gafforien	40
			0	1	0	6
	Khatlon	Bokhtar	PF Sobir	26	PF Sobir	41
		*	PF Buri	27	PF Buri	42
		Khodjamaston	PF Chabbor	28	PF Ismat	43
		*	PF S.Jandorov	29		
		Vaksh			PF Safari	44
		Gozimalik	DF Radjab	30	DF Radjab	45
		*	PF Shukhrat	31	PF Shukhrat	46
		*			PF Firuz	47
		Dangara	PF Sharif Shirin	32		
		Sarband				
		Kolkhozabad				
		Djililkul				
			0	7	0	7
UZBEKISTAN	Ferghana	Kuva	PF Olmazor	33	PF Akhmad Ata	48
		*	PF Kuyeshkhon	34	PF Mirkhamid	49
		*	PF Kasimkarvon	35	PF Kasimkarvon	50
		*	PF U.Samanov	36		
		Oltiaryk	PF Khadj	37	PF Khadj	51
		*	PF Zulaikho	38	PF Odiljon	52
		Besharyk	PF Zarbulok	39	PF Zarbulok	53
		*			PF Otajon	54
		*			PF Kora Jida	55
		*			PF Yangi Khayet	56
			0	7	0	9
	ry a	Nishan				

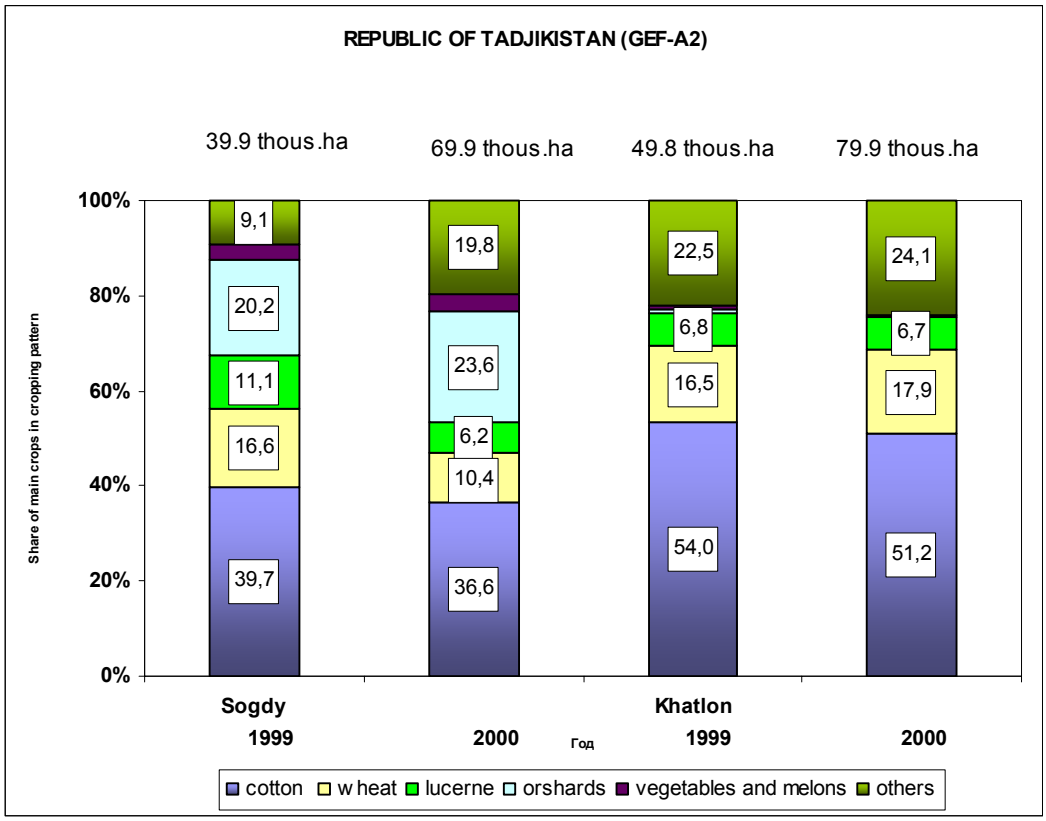
Republic	Oblast	Rayon	Private Farms			
			1999		2000	
			Name	○	Name	○
		Kamashi	PF Diyer	40	PF Diyer	57
		*			PF Tabbaruk Zamin	58
		*			PF Mamat	59
		Shakhrizyabz			PF Suluv Momo	60
		Karshi			PF Faiz	61
		Kasbi	PF Khakkulabrui	41	PF Khakkulabrui	62
		*	PF Davron	42		
		*	PF R. Fakhritdin	43	PF Ruzimat	63
		Kasan	PF Koson	44	PF Koson	64
		*	PF Kuga	45	PF Kuga	65
		*	PF Mulali	46	PF Maidanak	66
		*	PF Maidanak	47	PF Tulga	
		*	PF Usmon Bobo	48		
		*	PF Ulugbek	49		
				10		10
				49		**65**

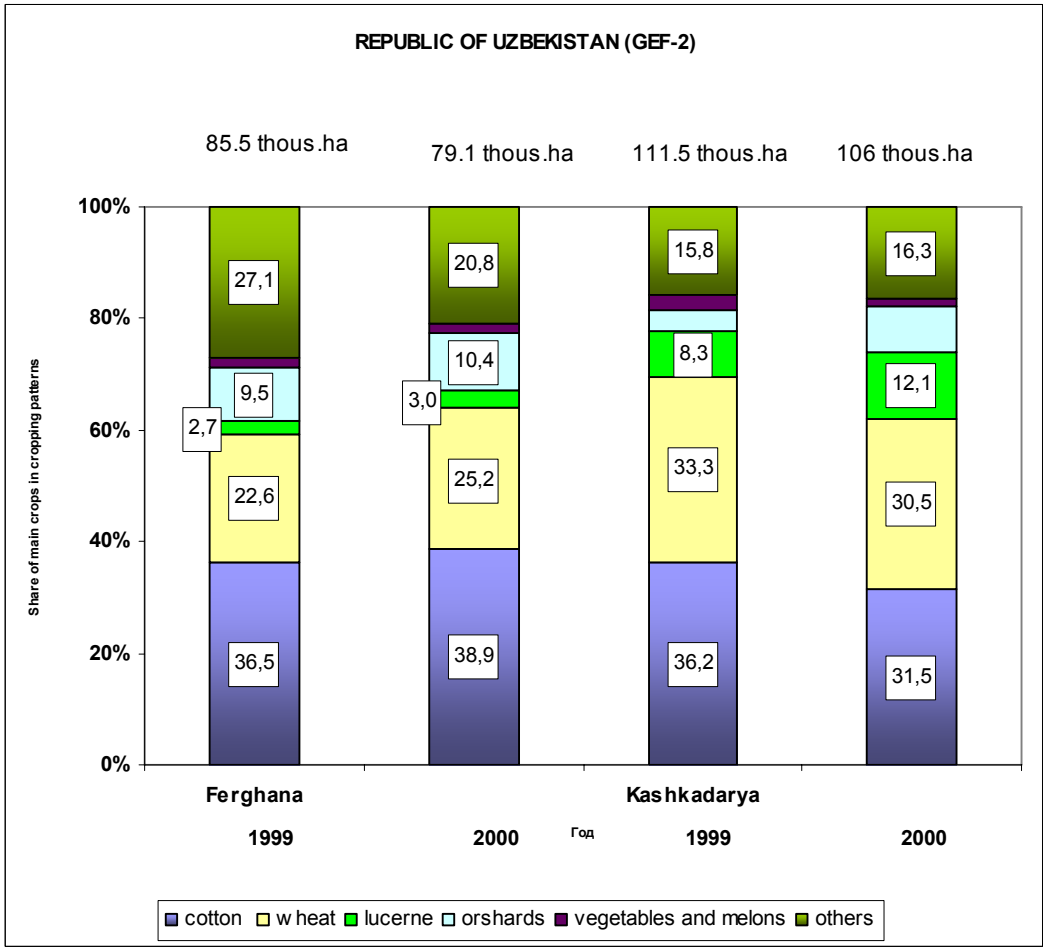
ANNEX B

CROPPING PATTERNS ON IRRIGATED LANDS - VEGETABLE SEASON 2000


REPUBLIC OF KAZAKSTAN (GEF-A2)
68.7 thous.ha
132 thous.ha
184.9 thous.ha
203.5 thous.ha
Share of main crops in cropping patterns
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
40,7
7,2
16,3
7,2
16,8
7,0
30,3
9,1
8,2
6,7
9,3
8,6
66,1
10,2
5,5
11,5
10,9
61,2
Kzylorda
South Kazakstan
1999
2000
Год
1999
2000
cotton
w heat
lucerne
rice
vegetables and melons
others

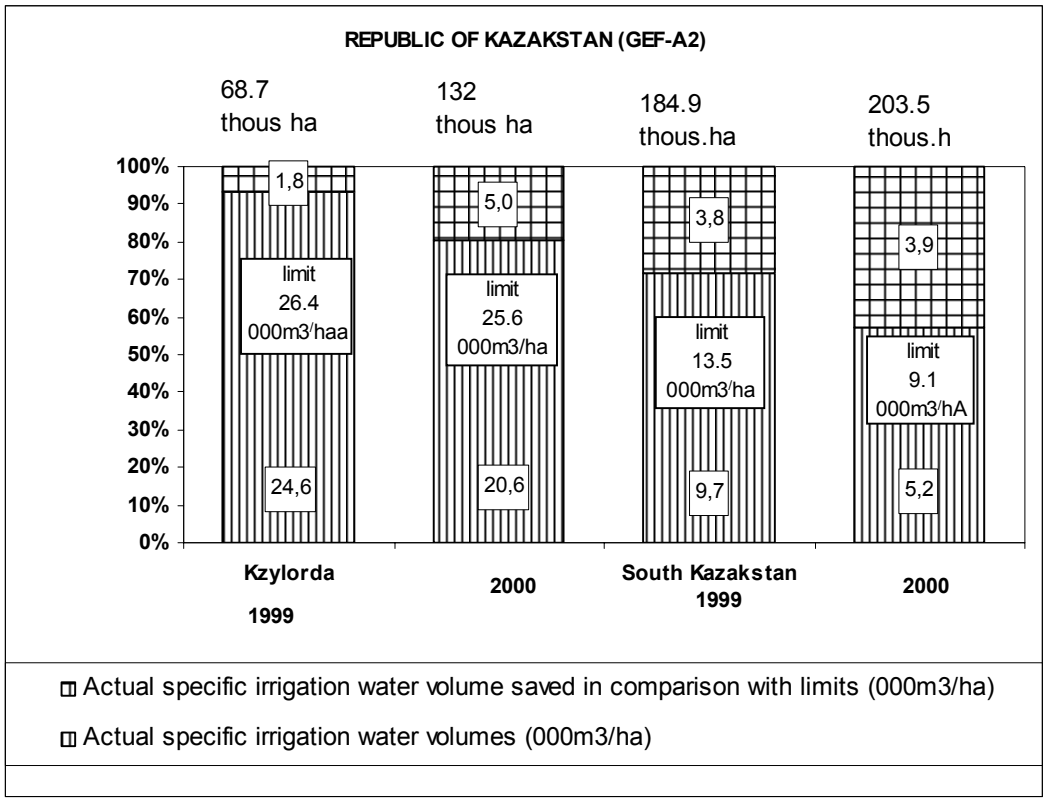

KYRGYZ REPUBLIC (GEF-A2)
47.2 thous.ha
86.6 thous.ha
91.5 thous.ha
83 thous.ha
Share of main crops in cropping patterns
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
45,6
4,9
4,3
30,5
15,3
48,6
4,0
5,2
19,3
20,8
64,5
5,1
5,9
28,1
12,3
45,7
4,0
6,1
31,3
12,9
Djalalabad
Osh
1999
2000
Год
1999
2000
cotton
w heat
maize for grain
tobacco
vegetables and melons
others

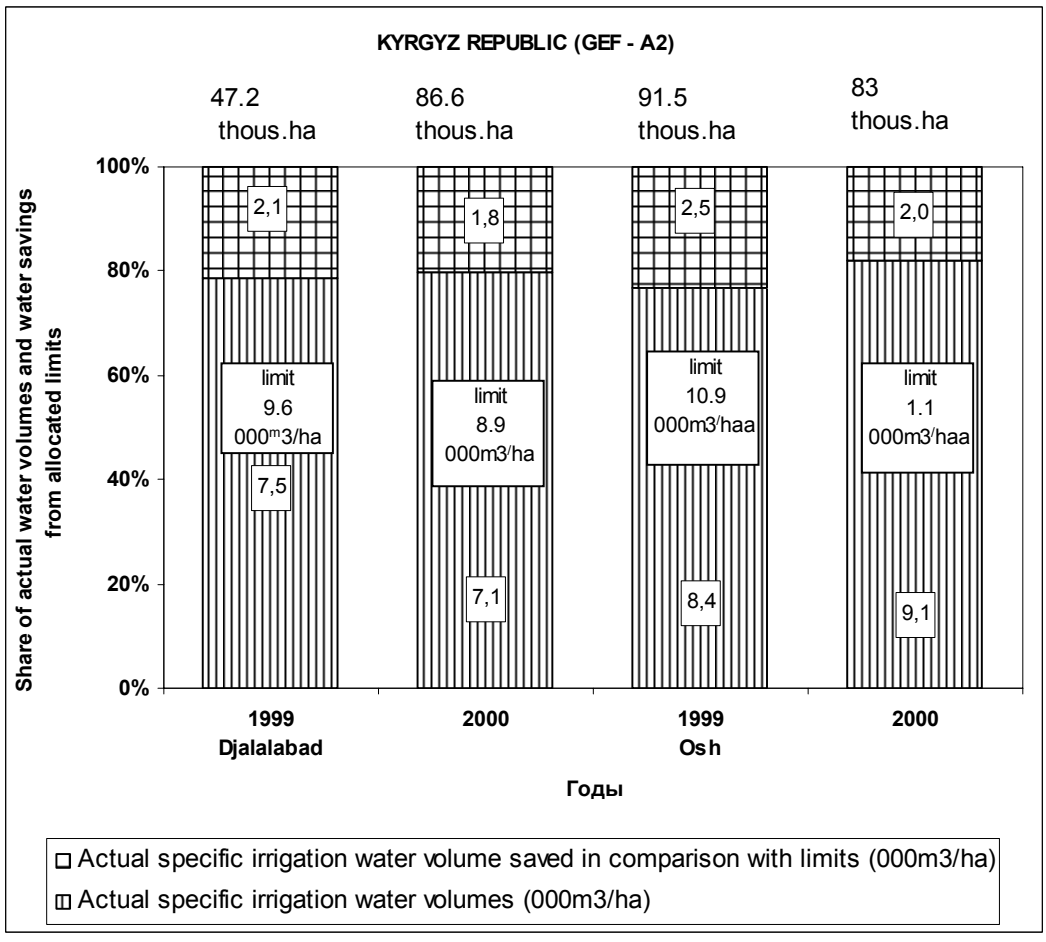

REPUBLIC OF TADJIKISTAN (GEF-A2)
39.9 thous.ha
69.9 thous.ha
49.8 thous.ha
79.9 thous.ha
Share of main crops in cropping pattern
100%
80%
60%
40%
20%
0%
9,1
20,2
11,1
16,6
39,7
19,8
23,6
6,2
10,4
36,6
22,5
6,8
16,5
54,0
24,1
6,7
17,9
51,2
Sogdy
Khatlon
1999
2000
Год
1999
2000
cotton
w heat
lucerne
orshards
vegetables and melons
others

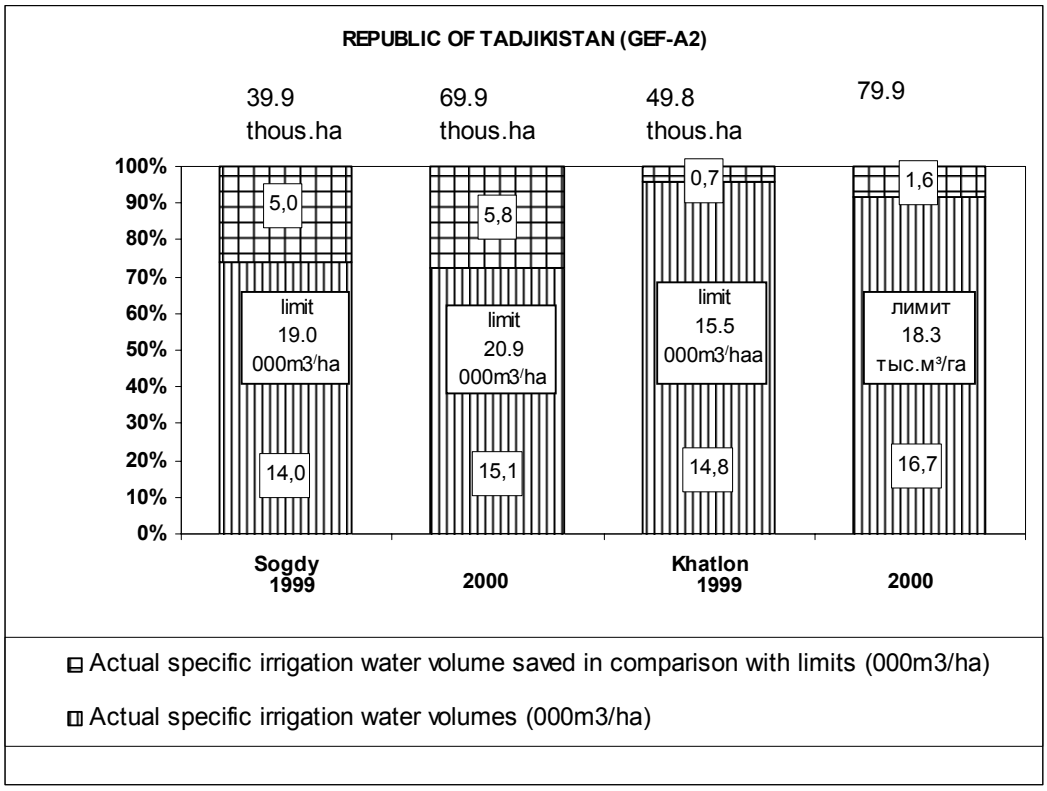

REPUBLIC OF UZBEKISTAN (GEF-2)
85.5 thous.ha
79.1 thous.ha
111.5 thous.ha
106 thous.ha
Share of main crops in cropping patterns
100%
80%
60%
40%
20%
0%
27,1
9,5
2,7
22,6
36,5
20,8
10,4
3,0
25,2
38,9
15,8
8,3
33,3
36,2
16,3
12,1
30,5
31,5
Ferghana
Kashkadarya
1999
2000
Год
1999
2000
cotton
w heat
lucerne
orshards
vegetables and melons
others

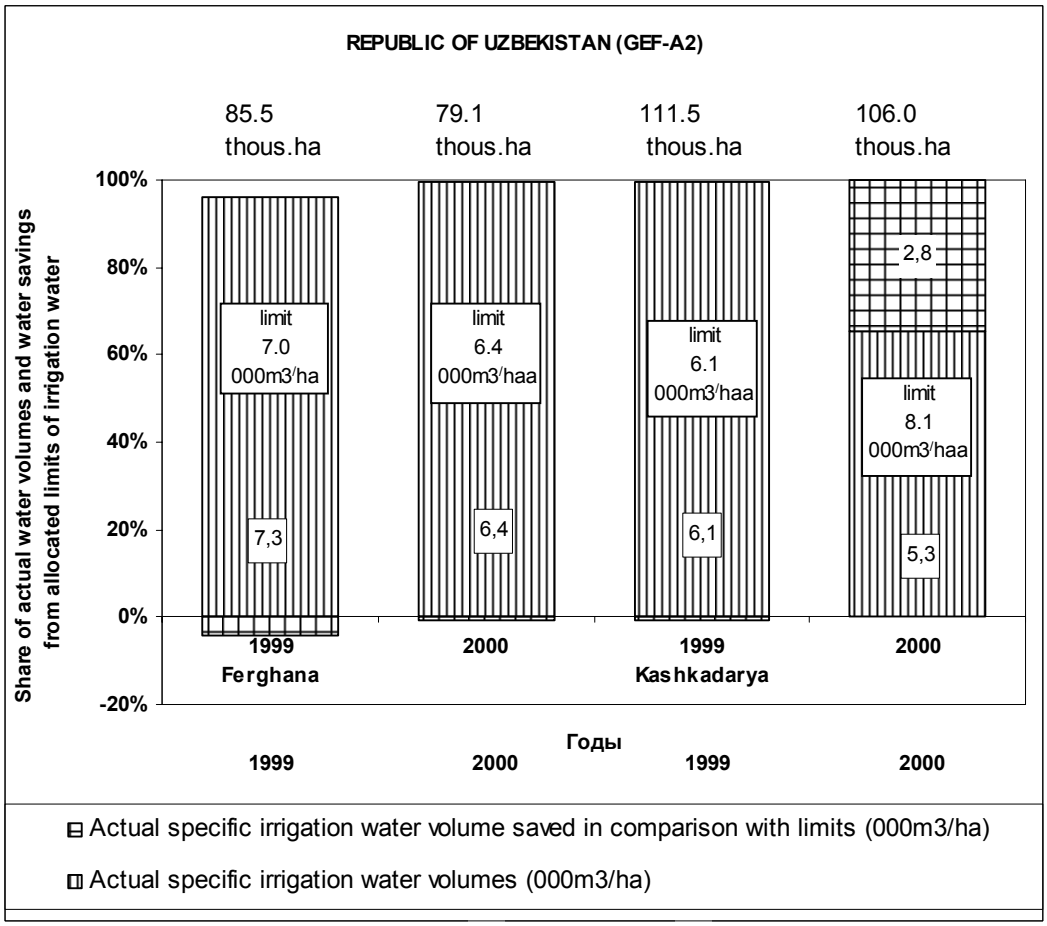
ANNEX C

WATER SAVINGS - VEGETATIVE SEASON 2000


REPUBLIC OF KAZAKSTAN (GEF-A2)
68.7 thous ha
132 thous ha
184.9 thous.ha
203.5 thous.h
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1,8
limit 26.4 000m3/haa
24,6
5,0
limit 25.6 000m3/ha
20,6
3,8
limit 13.5 000m3/ha
9,7
3,9
limit 9.1 000m3/hA
5,2
Kzylorda 1999
2000
South Kazakstan 1999
2000
Actual specific irrigation water volume saved in comparison with limits (000m3/ha)
Actual specific irrigation water volumes (000m3/ha)


KYRGYZ REPUBLIC (GEF - A2)
47.2 thous.ha
86.6 thous.ha
91.5 thous.ha
83 thous.ha
Share of actual water volumes and water savings from allocated limits
100%
80%
60%
40%
20%
0%
2,1
limit 9.6 000m3/ha
7,5
1,8
limit 8.9 000m3/ha
7,1
2,5
limit 10.9 000m3/haa
8,4
2,0
limit 1.1 000m3/haa
9,1
1999 Djalalabad
2000
1999 Osh
2000
Годы
Actual specific irrigation water volume saved in comparison with limits (000m3/ha)
Actual specific irrigation water volumes (000m3/ha)


REPUBLIC OF TADJIKISTAN (GEF-A2)
39.9 thous.ha
69.9 thous.ha
49.8 thous.ha
79.9
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
5,0
5,8
0,7
1,6
limit 19.0 000m3/ha
limit 20.9 000m3/ha
limit 15.5 000m3/haa
лимит 18.3 тыс.м³/га
14,0
15,1
14,8
16,7
Sogdy 1999
2000
Khatlon 1999
2000
Actual specific irrigation water volume saved in comparison with limits (000m3/ha)
Actual specific irrigation water volumes (000m3/ha)


REPUBLIC OF UZBEKISTAN (GEF-A2)
85.5 thous.ha
79.1 thous.ha
111.5 thous.ha
106.0 thous.ha
Share of actual water volumes and water savings from allocated limits of irrigation water
100%
80%
60%
40%
20%
0%
-20%
limit 7.0 000m3/ha
limit 6.4 000m3/haa
limit 6.1 000m3/haa
limit 8.1 000m3/haa
2,8
7,3
6,4
6,1
5,3
1999
2000
1999
2000
Ferghana
Kashkadarya
Годы
1999
2000
1999
2000
Actual specific irrigation water volume saved in comparison with limits (000m3/ha)
Actual specific irrigation water volumes (000m3/ha)

ANNEX D

YEILD OF CROPS ON IRRIGATED LANDS - VEGETABLE SEASON 2000

KAZAKHSTAN	Kzylorda Oblast	Rayon	Vodkhoz												
			Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Shieli	Shieli DWMS		0,86		4,00		3,50	2,20	10,20				12,20
		Janakurgan	Janakurgan DWMS		0,80	0,69	2,80		3,40	1,20	8,25				12,80
		Syrdarya	Kzylorda DWMS		0,81	1,00			4,10		8,70				9,00
		Syrdarya	Syrdarya DWMS		1,01	2,03			4,30		10,90				11,60
		Karmakchi	Karmakchi DWMS		1,05	0,28			4,30	0,20	8,30				11,30
		Jalagash	Jalagash DWMS		1,21	0,27			4,00		10,40				11,82
		Rayon	Kolkhozes, Associations, Farms, Cooperatives												
			Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Shieli	FLR Akmaya-2		1,07	0,51			2,76						6,80
		Shieli	FLR Gigant		0,93	0,47			3,68						7,10
		Janakurgan	S/f Togusken		1,90	3,76			3,91						
		Karmakchi	RPC Jonajol		0,53	0,79			6,16						5,80
		Karmakchi	PC Dostyk & C			0,53			5,01						2,86
		Syrdarya	FLR Shagan		0,78	1,00			5,94						
		Syrdarya	FLR N. Ilyasov		0,70	0,83			2,83		11,20				11,50
		Jalagash	PC Shamenov		1,00	0,50			5,20						
		Rayon	Private Farms												
			Private Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	for Silage	Rice	Sunflower	Potato	Tobacco	Orchards	Vines	Vegetables and Melons

		Shieli	Ps.F Jety agayin		0,10	0,27			5,73						
		Shieli	Ps.F Izgilik		1,14	1,60			2,46						4,50
		Shieli	Ps. F Maksat						3,00						
		Shieli	Ps. F Akniyet		0,10	1,00			3,97						
		Shieli	PF Sapar						4,50						
		Shieli	FLR Nartay		1,14	2,51			2,33						
		Shieli	FLR Bikmenbet		1,29	1,00			5,27						
		Shieli	FLR Talaptan - 2		1,18	1,80			4,64						
		Janakurgan	Ps. F Jana Jol Az		1,31	1,92			3,72						
		Janakurgan	Ps. F Tyrlibek		1,40	1,36			3,75						
		Janakurgan	Ps. F Juldyz		0,28										
		Jalagash	Ps. F Algabas			0,50			5,00						

KASAKSTAN	South Kasakstan Oblast	Rayon	Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
				Vodkhoz											
		Makhtaaral	Makhtaaral DWMS	2,02	3,08	2,40	3,30				10,56				20,74
		Turkestan	Turkestan DWMS	1,24	1,58	1,86	2,26				6,72				22,70
		Shardara	Kyzylkum DWMS	2,02	1,84	1,20	2,81		3,17		10,90				31,08
		Rayon	WUA												
			WUA	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons

		Makhtaaral	APC Rakhat	N/A															
		Makhtaaral	WUA Aray	N/A															
		Makhtaaral	WUA Makhtaly																
		Rayon	Kolkhozes, Associations, Farms, Cooperatives																
			Farm Name	including:															
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons				
		Makhtaaral	PC Dostyk & C	2,80	3,18	10,40													
		Makhtaaral	PC Ketebai	2,53	3,20	10,00		35,00											
		Turkestan	PC Farkhad	1,42	1,33	2,93									5,00				
		Turkestan	PC Koktondy Ata	1,11	2,09	4,40	0,00			0,00					4,23				
		Shardara	RSCE Komsomol	1,56	0,94	0,90			2,04										
		Shardara	SCE Jaysan	1,39	1,05	4,62			2,20				2,22		25,00				
		Sayram	PC Yassavi																
		Rayon	Private Farms																
			Private Farm Name	including:															
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons				
		Makhtaaral	PR Abildayev	2,50															
		Turkestan	PF Amerdin Ata	2,66															
		Turkestan	PF Koshkar Ata	1,27															
		Turkestan	PF Rais Baba	3,10	2,60														
		Shardara	PF Janibek	2,90															
		Shardara	PF Asem																

KYRGYZSTAN	Osh Oblast	Rayon	Vodkhoz												
			Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Karasu	Karasu RDWM	2,60	3,20		6,28			1,80		3,00			
		Nookat	Nookat RDWM												
		Aravan	Aravan RDWM	4,00	4,20		6,28					3,50			14,80
		Uzgen	Uzgen RDWM		2,36		5,90					2,51			2,45
		Rayon	WUA												
				including:											
			WUA	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Karasu	WUA Rakhmat	2,50	4,30		6,94				17,33	2,63			
		Karasu	WUA Jany Aryk	2,50	4,40							3,71			17,50
		Aravan	WUA Sakhy Darya	4,00	4,20							3,50			31,50
		Kadamjay	WUA Kaindy Okhna		3,50		6,10					2,90			28,00
		Rayon	Kolkhozes, Associations, Farms, Cooperatives												
				including:											
			Farm Name	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons

		Karasu	JSC Uch Kairagach	3,00	4,50									
		Nookat	Ps.A Saliyeva											
		Uzgen	JSC Bee Brooder		4,00				1,76			1,62		
		Rayon	Private Farms											
			Private Farm Name	including:										
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Karasu	Ps.F Mungush	4,30						1,50					
		Karasu	PF Maksat	2,80	5,40		5,40								25,00
		Aravan	PF Ogalik	2,80	2,60										
		Uzgen	PF Shabdan		3,00										
		Uzgen	PF Ak Emgek							1,80					
		Karakuljan	PF Kok Jar								15,00				

KYRGYZSTAN	Djalalabad Oblast	Rayon	Vodkhoz											
			Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Alabuka	Alabuka RDWM		3,00		4,70					2,30			13,00
		Aksy	Aksy RDWM	2,40	6,70		4,50					2,20			
		Suzak	Suzak RDWM	2,50	3,00		5,50					2,50			8,00
		Nooken	Nooken RDWM	2,50	2,70							2,10			15,40

Rayon	WUA	WUA including: Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
Suzak	WUA Bulak Suu	2,80	4,00		5,80					2,60			17,60
Nooken	WUA Nooken-K	3,10	2,56		4,80					2,40			1,50
Nooken	WUA Kyzyl - Ai	3,90	2,72		4,30			1,80					2,00

Rayon	Farm Name	Kolkhozes, Associations, Farms, Cooperatives including: Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
Alabuka	SSGF Ak Korgon		3,45					1,40		2,70			22,50
Suzak	AC Akykat		2,80					2,00		2,40			18,00
Suzak	AC Toktosunov	2,75	3,90							2,80			
Suzak	SSGF A.Yunusov	2,60	3,00										
Nooken	AC Kench	2,45	4,20										
Toktogul	Ps.C Chychkan		3,20		5,80			1,80					

Rayon	Private Farm Name	Private Farms including: Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons

		Alabuka	Ps.F Jenish		3,60					1,20					13,00
		Alabuka	Ps.F Kulet Ata		3,58					1,80	11,80				
		Alabuka	Ps.F Naimetov	2,50	3,70										12,00
		Bazar Korgon	Ps.F Alatoo	2,50		6,00									
		Bazar Korgon	Ps.F Kyzyl Ata	3,00	3,50										
		Aksy	Ps.F Intymak				4,90				12,00	2,50			
		Suzak	Ps.F Ak Tilek		3,30		6,20			1,50		2,80			
		Suzak	Ps.F Jigach Korgon				5,10			1,30					
		Suzak	Ps.F Jaichi		3,12	6,80				1,40					

TAJIKISTAN	Sogd Oblast	Rayon	Vodkhoz													
			Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kanibadam	Kanibadam WMA	2,57											
		Djabbar Rasulov	Djabbar Rasulov WMA	1,62											
		Bobojan Gafurov	Bobojan Gafurov WMA	2,27											
		Rayon	Kolkhozes, Associations, Farms, Cooperatives												
			Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kanibadam	JSC Iram	3,28	2,37			19,50							20,59

		Kanibadam	JSC Boimatov	3,50	3,07	26,59							3,06		38,77
		Djabbar Rasulov	K-z Samadov												
		Djabbar Rasulov	AC Digmay	2,51	3,41	15,24							1,18		3,49
		Bobojan Gafurov	JSC A.Rakhimboyev										6,28	2,20	
		Bobojan Gafurov	JSC Jumayev	2,59		37,42		35,13	3,24						32,31
		Bobojan Gafurov	K-z Rasulov	3,11	2,71	9,40	6,40								36,54
		Matchi	AC Zarifiyen												
		Rayon	Private Farms												
			Private Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kanibadam	PF Gafurov	2,37	2,91								2,14	2,11	
		Kanibadam	DF Faravon	4,12	4,81	41,84							2,54		55,60
		Kanibadam	PF Samonien	4,84	2,87	18,95									42,50
		Djabbar Rasulov	PF Sayed	1,44	3,00	15,00							10,00		20,00
		Djabbar Rasulov	DF Zarzamin												
		Zafarabad	DF Davronien	2,90	1,40	3,00		8,50							8,50
		Zafarabad	PF Obijon	2,80											
		Zafarabad	PF Yusufi												
		Matchi	PF Gafforien	3,65	1,20										10,00

TADJIKISTAN	Khatlon Oblast	Rayon	Vodkhoz												
			Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Bokhtar	Bokhtar HAPROA	1,35	2,30	17,50									11,00

		Khodjamaston	OD Shurabad IN	0,79	0,82		0,33		0,20						
		Vaksh	OD Vaksh IN	1,55	1,74	13,00									22,29
		Rayon	Kolkhozes, Associations, Farms, Cooperatives												
			Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Bokhtar	K-z Kommunizm	1,57	2,50	19,80									24,25
		Bokhtar	S-z F. Saidov	2,00	2,60	18,10									16,89
		Khodjamaston	K-z Lenin	0,86	1,30		6,20		1,00						
		Khodjamaston	K-z Komsomol	1,05	0,70		2,00		2,00						
		Vaksh	K-z Kulob	1,79	2,47	38,92									8,50
		Vaksh	K-z Leningrad	0,72	1,86	7,44									0,81
		Gozimalik	S-z Bobojonov	0,68	0,29	8,33									2,25
		Sarband	K-z R. Odinayev	2,27	2,00	13,00									9,00
		Kolkhozabad	K-z S. Jumayev	2,39	2,29	16,63									
		Kolkhozabad	K-z Lenin	1,06	1,62	15,32									
		Rayon	Private Farms												
			Private Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Bokhtar	PF Sobir	0,92					2,50						
		Bokhtar	PF Buri	1,00	2,00										
		Khodjamaston	PF Ismat	2,10	1,40			5,33							5,60

		Vaksh	PF Safari	2,69	1,82	30,14									14,00
		Gozimalik	DF Radjab	0,43	0,70										
		Gozimalik	PF Shukhrat						1,65						
		Gozimalik	PF Firuz	1,75	2,88										

UZBEKISTAN	Ferghana Oblast	Rayon	Vodkhoz												
			Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kuva	Kuva RDAWM	2,68	3,37	4,68	2,70								5,80
		Oltiaryk	Oltiaryk RDAWM	3,34	3,38	0,10	1,01								6,34
		Besharyk	Besharyk RDAWM	2,44	3,67	0,93	4,35								
		Rayon	Kolkhozes, Associations, Farms, Cooperatives												
			including:												
		Rayon	Farm Name	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kuva	K-z Navoi	3,02	4,50			28,00							9,05
		Kuva	K-z Khakikat	3,75	8,64	15,00	4,40								50,50
		Kuva	K-z Rakhmatov	3,52	5,30	27,20		26,00							5,00
		Oltiaryk	K-z Al Fargoni	3,17	4,33	6,63		20,00							
		Oltiaryk	K-z Navoi	3,44	3,72	7,50	10,00								
		Besharyk	K-z Rapkon	4,15	4,77	15,72		24,83							6,00

		Besharyk	K-z Dustlic	2,75	3,33	19,88									10,20
		Besharyk	K-z Uzbekistan	3,76	4,31	12,00	2,90								16,37
		Rayon	Private Farms												
			Private Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kuva	PF Akhmad Ata		4,00				2,98						
		Kuva	PF Mirkhamid	3,75	5,08										9,18
		Kuva	PF Kasimkarvon	4,70	4,50										13,00
		Oltiaryk	PF Khadj		2,20	12,00		23,33							60,00
		Oltiaryk	PF Odiljon	3,63	4,00										
		Besharyk	PF Zarbulok			49,40		13,85							
		Besharyk	PF Otajon		1,70										
		Besharyk	PF Kora Jida	2,92	3,36										
		Besharyk	PF Yangi Khayet	3,67		46,44									

UZBEKISTAN	Kashkadarya Oblast	Rayon	Vodkhoz												
			Vodkhoz	Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kamashi	Kamashi RDAWM	1,40	1,26	12,86									
		Shakhrizjabz	Shakhrizjabz r-n MCDM	2,13	3,63	8,30	3,15								
		Karshi	Karshi RDAWM	2,40	2,03	3,72	5,21								
		Rayon	Kolkhozes, Associations, Farms, Cooperatives												
			Farm Name	including:											

				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kamashi	K-z Karabag	1,57	1,69	14,58									
		Kamashi	K-z Chimkurgan	2,17	1,72	11,02									17,30
		Shakhrizjabz	K-z Ulugbek	4,98	2,91	12,28		10,50							1,91
		Shakhrizjabz	K-z Amir Timur	2,04	3,27	7,96	1,95								
		Shakhrizjabz	K-z Uzbekistan	1,94	1,87	10,24		14,16							
		Karshi	K-z Yakshi Omonov	3,42	3,47	20,68		22,47							6,58
		Kasbi	K-z Kh. Khujakulov	2,99	2,12	7,29	14,75								
		Rayon	Private Farms												
			Private Farm Name	including:											
				Cotton	Wheat	Lucerne	Maize for Grain	Maize for Silage	Rice	Sunflower	Potato	Tobaccoo	Orchards	Vines	Vegetables and Melons
		Kamashi	PF Diyer		3,20	13,50									
		Kamashi	PF Tabbaruk Zamin	3,25											
		Kamashi	PF Mamat		3,25	8,00									
		Shakhrizjabz	PF Suluv Momo	1,60	3,70										
		Karshi	PF Faiz	3,67	4,00										30,00
		Kasbi	PF Khakkulabrui	3,56	5,60										
		Kasbi	PF Ruzimat	3,50	3,50										
		Kasan	PF Koson	2,70	1,90										
		Kasan	PF Kuga	2,64	1,29										
		Kasan	PF Maidanak	2,30		1,88									
		Kasan	PF Tulga												

ANNEX E

DISTRIBUTION OF PRIZES RECOMMENDED BY NATIONAL AND REGIONAL MONITORS BASED ON RESULTS OF “WATER SAVING” COMPETITION

Republic	Oblast	Year	Vodhozs		WUA		Kolhozs/associations of farms/cooperatives				Peasant and private farms			
			Ist place	2nd place	Ist place	2nd place	Ist place	2nd place	3rd place	3rd place	Ist place	2nd place	3rd place	3rd place
KAZAKHSTAN	Kyzyl-Orda	1999	Zhana-korgan	Shieli			Associa-tion Akmal-2	Associa-tion «Akniet»	Not awarded	Not awarded	Not awarded	Not awarded	Not awarded	Not awarded
		2000	Karmak-chi	Zhala-gash			Coopera-tive Zhanajol	Associa-tion Shagan	Coopera-tive Dostyk	Coopera-tive Shameno v	Peasant farm Zheti-again	Peasant farm Algabas	Associa-tion Shagan	Peasant farm Zhanajol
	South-Kazakhstan	1999	Turkectsn	Mak-htaaral			Komso-mol	WUA Yernar	Zhaisan	Coopera-tive Ikan	Peasant farm Amerdin-ata	Peasant farm Zhanibek	Peasant farm Koshkar-ata	Peasant farm Abil-dayev
		2000	Kyzylkum	Mak-htaaral			Coopera-tive Keterbai	Coopera-tive Dostik	Coopera-tive Farkhad	Zhaisan	Peasant farm Rais-baba	Peasant farm Amerdin-ata	Peasant farm Zhanibek	Peasant farm Abil-dayev

Republick	Oblast	Year	Vodkhozs		WUA		Kolkhozs/associations/cooperatives				Peasant and private farms			
			1st place	2nd place	1st place	2nd place	1st place	2nd place	3rd place	3rd place	1st place	2nd place	3rd place	3rd place
KYRGYZSTAN	Jalalabad	1999	Aksiy	Ala-Buka			Coopera-tive Tokto-sunov	Coopera-tive Kench	Coopera-tive Akiykat	Coopera-tive. Ak-korgon	Peasant farm Inti-mak	Peasant farm Zhenish	Peasant farm Kizir-ata	Peasant farm Ala-too
		2000	Ala-Buka	Aksiy	WUA Kyzy-lai	WUA Bu-laksu	Coopera-tive Ak-korgon	Coopera-tive Chichkan	Coopera-tive Tokto-sunov	Coopera-tive Akiykat	Peasant farm Ak-tilek	Peasant farm Inti-mak	Peasant farm Kule-tata	Peasant farm Zha-ichi
	Osh	1999	Karasu	Nookat			WUA Rakhmt	WUA Sahiy-Daryo	WUA Zhaniarik	Coopera-tive Saliyeva	Peasant farm Akemgek	Peasant farm Mungush	Peasant farm Shabdan	Peasant farm Maksat
		2000	Uzgen	Aravan	WUA Kain-diona	WUA Zha-niarik	Associa-tion Uzgen bee plant	Associa-tion Uchkaira-gach			Private farm Kokzhar	Peasant farm Mun-gush	Private farm Maksat	Private farm Shabdan

Republick	Oblast	Year	Vodkhozs		WUA		Kolkhozs/associations/cooperatives				Peasant and private farms			
			1st place	2nd place	1st place	2nd place	1st place	2nd place	3rd place	3rd place	1st place	2nd place	3rd place	3rd place
TAJIKISTAN	Sogd	1999	Kani-badam RWO	Zhabar Rasulov RWO			JSV Iram	JSV A.Rakhim bayev	Kolkhoz E.Khasa nova	Kolkhoz P.Bobokolo nov	Private farm Davonien	Not awarded	Not awarded	Not awarded
		2000	Kani-badam RWO	Zhabar Rasulov RWO			JSV Baimatov	Kolkhoz J.Rasulov	JSV Iram	JSV A.Jumayev	Dehkan farm Faravon	Private farm Obi-jon	Private farm Samonien	Private farm Gafforien
	Khatlon	1999	GMPREO	USHOS			Sovkhoz F.Saidov	Kolkhoz R.Odinaye v	Kolkhoz Kulob	Kolkhoz S.Jumayev	Private farm Sobir	Private farm Buri	Private farm Shukhrat	Private farm Chabbor
		2000	GMPREO	Vakhsh WA			Kolkhoz S.Jumate v	Sovkhoz F.Saidova	Kulob	Kolkhoz «Кулоб»	Private farm Sa-fari	Private farm Ismat	Private farm Firuz	Private farm Sobir

Republicka	Oblast	Year	Vodkhozs		WUA		Kolkhozs/associations/cooperatives				Peasant and private farms			
			Vodkhozs	**WUA**	**Kolkhozs/associations/cooperatives**	**Peasant and private farms**	**Vodkhozs**	**WUA**	**Kolkhozs/associations/cooperatives**	**Peasant and private farms**	**Vodkhozs**	**WUA**	**Kolkhozs/associations/cooperatives**	**Peasant and private farms**
UZBEKISTAN	Fertghana	1999	Besharik	Kuva			Kolkhoz Named after Altiarik	Kolkhoz Khakimiat	Kolkhoz Rapkon	Kolkhoz Kuzi-bayev	Private farm Khazh	Private farm Zarbulak	Private farm Kosim-Korvon	Private farm Mustakil-lik
		2000	Kuva	Besharik			Kolkhoz rakhma-tov	Kolkhoz Khakikat	Kolkhoz Rapkon	Kolkhoz Dustlik	Private farm Kosim-Korvon	Private farm Odilzhon	Private farm Zarbulak	Private farm Mirhomid
	Kashkadarya	1999	Kamashi	Shahrizabs			Kolkhoz Uzbeki-stan	Kolkhoz Karabag	Kolkhoz K.Khuzhaulov	Kolkhoz Tukbai	Private farm Diyor	Private farm Khakkul-Abrui	Private farm Kuga	Private farm Koson
		2000	Shahrizabs	Karshi			Kolkhoz M.Ulugbak	Kolkhoz Ya.Omonov	Kolkhoz Uzbeki-stan	Kolkhoz K.Khojakulov	Private farm Ruzimat va holbibi	Private farm Faiz	Private farm Diyor	Private farm Koson

Address:
SIC ICWC
11, Karasu-4, Tashkent, 700 187,
Republic of Uzbekistan

www.icwc-aral.uz

Page-proof and design by I. Beglov

info@icwc-aral.uz

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