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**Identification of barriers on utilization of ground water for irrigation in
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Identification of barriers on utilization of ground water for irrigation in Uzbekistan and Kazakhstan

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Identification of barriers on utilization of ground water for irrigation in Uzbekistan and Kazakhstan

Introduction

Purpose of this research activity was to discover barriers to wide application of ground waters for irrigation. These studies were conducted in three districts of Fergana province of Uzbekistan and two districts of Southern Kazakhstan. Socio-economic survey conducted among farmers – water users has been applied as research method. Over 70 farmers in three WUA of Fergana province of Uzbekistan and over 70 farmers of South-Kazakhstan province of Kazakhstan participated in the survey. The questionnaire was mainly focused on characteristics of farms, applied farming practices, problems of irrigation and drainage, issues of crop production and level of income. Comparative analysis of production factors using different water sources was studied. The studies revealed that in Fergana province relatively high maintenance cost of vertical wells and high cost of electricity under state controlled agricultural production system is the main barrier for wide use of ground waters for irrigation. In Southern Kazakhstan, there were selected two different zones with relatively good and poor quality of ground waters. It was found that poor water quality and poor status of existing wells are main barriers to wide application of ground waters in Kazakhstan.

I. Identification barriers to ground water use for irrigation in Fergana Valley

1.1. Comparative performance analysis of three WUA in Fergana province

Before starting to analyze economic situation of farm units in WUA we bring forward particularities and distinctions of conditions in three tested areas of Fergana province.

There are established 8 WUAs functioning **in Ahunbabay district**. Research activities were conducted on the premises of WUA named “Yangi Ariq Obi Hayot”. This WUA was founded in 2006. Total serving area is 2470 ha. The WUA utilizes 11 on-farm water distribution systems with total length of 95 km. Total length of open drainage is 34 km. Specific length of on-farm water distribution net is 38.5 r.m./ha and open drainage is 13.8 r.m./ha. There are 169 farms in total: 92 farms are specialized in cotton/wheat growing on 2150 ha area, 66 farms with total area of 1093 ha grow wheat, 7 livestock breeding farms with area of 199 ha, 56 horticultural farms with area of 7.1 ha, 4 farms engaged in silkworm. Average irrigated area of one farm is 29 ha, 21 farms utilize canal and drainage water conjunctively, 11 farms utilize only drain water, 5 farms (4 of which completely) utilize ground water for irrigation. The wells belong to “Soh-Aktepa” irrigation system management.

The WUA charges water users for supplied water as follows: for water from canal - 4200 UZS/ha, for drain water – 3360 UZS/ha. Horticultural farms are charged 8100 UZS/ha for supplied water (exchange rate - \$1US = 1257 UZS).

Bolshoy Fergana Canal (BFC), South Fergana Canal (SFC) and Bolshoy Andijan Canal (BAC) are sources of irrigation water. Limit of surface water on WUA border during vegetation period is 23.7 mln. m³. Share of BFC is 20.905 mln. m³ and irrigated area from the canal is 1978 ha. Non vegetation water permit is 7.838 mln. m³. For Central Fergana it is recommended to irrigate cotton 5 times at irrigation rate 600-1500 m³/ha and irrigate wheat 8 times at rate 850-1200 m³/ha. When sowing wheat in growing cotton it is recommended to irrigate cotton 3 times and wheat 6 times. On the area of 285 ha farmers conduct leaching at rate 1500 m³/ha on areas with low degree of salinity (100 ha), at rate 1500-2000 m³/ha on areas with medium degree of salinity (95 ha), at rate 2500-4000 m³/ha on areas of high degree of salinity (90 ha).

Total permit for summer irrigation is 9796 m³/ha. Considering delivery efficiency at on-farm net, farmers units receive 7500 m³/ha for summer irrigation and 2100 m³/ha for saline soil leaching in winter, in average.

There are established 8 WUAs in **Rishtan district**. Research activities were conducted at the premises of a WUA “Obi Hayot Ok Yer Farmers”. This WUA was founded in 2005. Total serving area is 1301 ha. Water intake source during spring is canal BFC-4 obtaining water from pumping station (PS) “Buloq Boshi”. Onwards water is transferred from canal to chute distribution net by three pumping stations. “Rishtansay” canal on the border of the WUA is also supplied with water from concrete canal named “Sokh-Shahimardan”. Thus, area of canal water irrigation is 1147 ha, with mechanical pumping – 288 ha, drain irrigation and other 54 ha. All of the 4 PSs belong to “Soh-Aktepe ISM (Irrigation System Management)”.

Total length of on-farm WUA net is 44.2 km. Out of which 39.0 km has ground bed, 4.4 km has concrete bed, 0.8 km has chute bed. Total length of drainage is 70.78 km, 47.89 km of which is open. Specific length of on-farm net is 34 r.m/ha and open drainage is 54.4 r.m/ha. There are 128 farms in total. Number of crop growing farms is 54 (cotton/wheat) with area of 811 ha, 2 livestock breeding farms, 74 horticultural farms and 1 vegetable growing farm. Over 62% from the total area of the WUA (784 ha) is under crop-growing (cotton/wheat) farms. Average irrigated area of one farm is 20 ha.

Ground water table on the research site is from 1-3 m depth. There are 4 wells in the WUA: 1 well is for drinking water (not functioning), 2 for drainage (one of them is not functioning – without pump) and one artesian well. All four wells belong to “Sokh Aktepe Irrigation Systems Management (ISM)”. One of the wells functioning for ground water lowering needs is 80 m deep. Farm “Abdullajon Toshmatov” is supplied with water from this well. The pump type is rotary pump 12-235-30, with electric capacity - 32 kW. Water distribution net of the farm consists of concrete bed - 0.3 km and earth bed - 0.94 km. Average irrigated area of one farm is 18 ha. The WUA charges for crop-growing farms (cotton-wheat) is at 12593 UZS/ha and horticultural farms 20000 sum/ha.

Total area of **Furkat district** is 17775 ha: 6700 ha are under cotton and 6107 ha are under wheat and other crops. There are 6 WUAs functioning in the district. Research activities were conducted at WUA named “Yangi Dunyo Suv Yollari”. This WUA was founded in 2005. Total area is 2814 ha, 849 ha are under cotton, 909 ha are under grain and other crops. Wheat is grown on 901 ha, including area of double cropped wheat on 450 ha. Water intake sources are derivations of BFC – “Kok doppi”,

“Soh Soy” and “Yangi Dunyo Ariq”. Length of derivation “Kok Doppi” is 41.9 km and it supplies water to 92 farms. Derivation “Yangi Dunyo Ariq” of 12.05 km length supplies water to 11 farms. Canals’ bed consists of 106.0 km of earth bed, 12.0 km of concrete bed and 3.0 km of chute bed. Total length of on-farm net is 120.0 km, drainage is 190 km long, 169.0 km of which is open. Specific length of on-farm net is 42.7 Rm/ha, drainage length is 68 r.m./ha. There are 166 farms in total: 156 crop growing farms (cotton-wheat), 5 horticultural farms and 2 livestock breeding farms. Average irrigated area of one farm is 12.6 ha. Surface water permit for WUA on the border of farms during vegetation is 15.05 mln. m³, during non-vegetation is 10.98 mln. m³.

Table 1. General data on research areas

Indicators	WUA Yangi Ariq Obi Hayot	WUA Ok Yer Fermeriga Obi Hayot	WUA Yangi Dunyo Suv Yollari
Water discharge to 1 ha of irrigated area, m ³ /ha	11024	12636	12204
Number of farms consuming water from canal	71	52	156
With mechanic pumping		52	92
Conjunctive use of canal and drainage water	21	2	
Drainage water only	11	2	
Ground water only	5		
Water charges, UZS/ha			
canal water	4200	12593	10000
drainage water	3360		
Water permit for summer season, mln. m ³	23.7	9.3	24.1

Table 2. Water use on borders of WUA under research during 2006

Name of irrigation system management	Year of WUA establishment	Serving area, ha		Specific length r.m ³		Number of farms	
		total	cotton-wheat growing farms	On-farm net	Drainage length	Total	cotton-wheat growing farms
WUA Yangi Ariq Obi Hayot	2006	2470	2150	38.5	14	169	92
WUA Ok Yer Fermeriga Obi Hayot	2005	1301	784	34	54	128	54
WUA Yangi Dunyo Suv Yollari	2005	2814	1973	42.7	67.5	166	156

Ground water table in the research area fluctuates is in range of 0.5 -3.0 m depth. The WUA charges for its services 10000 UZS/ha. Furrow irrigation is used in the farms which participated in the survey. Reason for not applying other irrigation technologies is that the newly created farms have no resources for adopting new technologies. But farmers realize efficiency of other irrigation techniques and welcome their application if credits are provided.

1.2 Research Methodology

To identify barriers to ground water use for irrigation, questionnaire was developed and socio-economic analysis conducted in the three district of Fergana Province, Uzbekistan and two districts of Southern Kazakhstan (Appendix 1). The questionnaire analyzes cost and benefits of crop production and cost of water supply and family budgets. By source of irrigation all respondents divided into three groups, farms using canal water for irrigation; farms using lifted pump water for irrigation and farms using ground water for irrigation.

1.3 Results of socio-economic survey

In the above mentioned districts there has been conducted a socio-economic survey by distributing questionnaires with participation of 67 farmers from crop growing farms. Statistic analysis of collected information was done with help of SPSS program. Results of the survey were entered into a spread sheet. Using the above data and information collected by questionnaire survey among farmers the following indices given in tables 3 and 4 were identified. The survey shows that WUA located in the upper, middle and lower reaches of BFC have different costs for water supply to farmers. Such an abrupt difference in costs can be explained by conditions of water supply.

WUA “Yangi Ariq Obi Hayot” is located in the upper reaches of BFC. Production cost of 1m³ irrigation water supplied to farmers is determined by expenses of Water Management Organization of Fergana province. According to the water provincial organization, average water delivery cost of 1m³ of water in Fergana province is 6.0 UZS/m³ in average. Water delivery cost through on-farm water delivery system at the study area (C_{if}) is in range of 2.1- 6.0 UZS/m³. Total delivery cost of 1m³ water on the farm border is:

$$C \text{ total} = C_{\text{interfarm}} + C_{\text{on-farm}}$$

Thus, total production cost of 1m³ on farm border is between 2.48 and 6.84 UZS per m³.

By water intake sources farms are divided into three groups.

- I group - farms using canal water
- II group - farms getting water from pumping stations
- III group - farms using ground water

Water delivery cost determined from budgets of Water Users Associations is given in the Table 4.

Table 3. Water delivery cost in Fergana province (2006)

WUA	On-farm water delivery cost UZS/m3	Inter farm water delivery cost, UZS/m3	Total cost of 1m3 water, UZS/m3
Yangi Ariq Obi Hayot. Water from canal	0.38	2.10	2.48
Obi Hayot to Farmer of Ok Yer. Water supply through pumping station	1.00	4.70	5.70
Yangi Dunyo Suv Yollari. Irrigation water from canal and well	0.82	6.02	6.84

Table 4. WUA budget for 2006

	Expenditures	Annual expenditures of WUA, thousand UZS		
		“Yangi Dunyo Suv Yollari”	“Obi Hayot to Farmer of Ok Yer”	“Yangi Ariq Obi Hayot”
I	Pay-roll fund	8105	8232.917	9368.8
1	Salaries			6613.3
2	Bonuses	1165.5		2204.4
3	Welfare	388.5		551.1
II	Total social transfers			1600
a)	Single social transfer 24%	1945.2		
b)	Pension fund 2.5%	202.6		
c)	Income tax 12%	972.6		
III	Administrative expenses	800	570	1008.5
1	Stationary expenses	150	150	400
2	Expenses on electric energy	150	100	60
3	Coal	250		
4	Communications	250	120	120
5	Building renovation		200	250
6	Depreciation			178.5
IV	Cost of operations	5020.6	3291.417	3900
1	Fuel	1600	900	250
2	Cleaning of irrigation-drainage net	1544.6	1000	2700
3	Construction of facilities and hydraulic power station	676		
4	Maintenance spare parts	1200	1000	600
5	Other expenditures		391.417	350
V	Contributions to specially allocated funds			150
1	Stock fund	700		
	Total:	19300	12094.334	16027.3

Analysis of water utilization has been done by two major crops: **cotton and wheat**. In order to assess efficiency of water utilization in farms a table of water productivity has been compiled (Table 5). Water productivity according to crop yield was determined by ratio of average yield to average specific water discharge during vegetation on 1 ha by separated groups. Water productivity by profit is found by ratio of profit to average specific water discharge during vegetation.

Analysis of operations costs was done by calculating variable and fixed costs. Variable costs:

$$C_{ver} = C_{till.} + C_{seeds} + C_{fert.} + C_{fe} + C_{lab.} + C_{harv.} + C_{cred.} \quad (\text{UZS/ha})$$

Where:

C_{ver} . – variable costs; $C_{till.}$ – technical tillage cost ; C_{seeds} – cost of seeds

$C_{fert.}$ – Cost of fertilizers; C_{fe} – Cost of fuel and electricity; $C_{lab.}$ – Cost of labor

$C_{harv.}$ – Cost of harvesting; $C_{cred.}$ – Interest cost for credit

Fixed costs include:

$$FC = C_{l.t.} + C_{water} + C_{depr.} + C_{cl.} \quad (\text{UZS/ha})$$

Where: FC – Fixed costs

$C_{l.t}$ – Land Tax

C_{water} – Water Charge

$C_{depr.}$ – Depreciation of Fixed Assets

$C_{cl.}$ – Cleaning of irrigation and drainage net

Table 5 contains calculations of the above indices.

Table 5. Analysis of water use efficiency

Induces	Ground water irrigation		Canal irrigation		Pumping irrigation	
	cotton	wheat	cotton	wheat	cotton	Wheat
Water discharge during summer (m3/ha)	7455	7455	7302	7302	8490	8490
During winter season (m3/ha)	3455	3435	3237	3237	3586	3586
Total water discharge (m3/ha)	10890	10890	10559	10559	12076	12076
Water productivity, kg/m3	0.22	0.39	0.25	0.38	0.22	0.40
Water productivity, UZS/m3	20.03	44.36	55.03	40.66	8.13	13.10
Share of water charges from total cost, %	1.8	2.2	1.1	1.5	1.9	2.6
Share of water charges from net profit, %	1.3	2.1	0.8	1.3	1.6	1.9

Table 6. Farms' economic indices

Crop	A	B	C	Average by districts
	Number of farms			
	34	24	9	22
Average area, ha				
Cotton	10.8	11.8	9.4	10.7
Wheat	10.4	8.9	8.6	9.3
Average variable costs, UZS/ha				
Cotton	548733	540279	560184	549732.4
Wheat	398778	420686	455280	424914.8
Average fixed costs, UZS/ha				
Cotton	32354	63206	32270	42610
Wheat	30609	25823	27855	28095
Average aggregate costs, UZS/ha				
Cotton	581087	603486	592454	592342
Wheat	429387	446508	483135	453010
Average specific profit, UZS/ha				
Cotton	198581	98144	218120	171615
Wheat	25165	158186	43803	75718
Average income, UZS/ha				
Cotton	779669	837263	837263	818065
Wheat	468326	604695	512090	497502
Profitability level, %				
Cotton	34	16.3	36.8	29
Wheat	5.9	35.4	9.1	16.7

Comparative analysis of production indices indicates that water productivity differs by crops in the studied groups. For cotton it fluctuates from 0.22-0.25 kg/m³, for wheat it fluctuates from 0.38-0.40 kg/m³ (Table 5). Cost analysis shows that share of fixed costs in total costs varies from 5.4% to 10.5%. Specific weight of water charges in total costs is from 0.1% to 2.6%. Water charge makes 0.6%-2.1% of income. Correlation method was used to analyze farmers' activities. Profit (P) from total farm's activity (cropping) as difference of marketed products' cost (MPC) and production cost (PC) has been determined as $P = MPC - PC$. Average indicators of research farms are given in Table 5.

1.4 Statistical assessment of economic efficiency of water use

Statistical relations were calculated using SPSS program. Major purpose of the analysis was to determine independent factors significantly affecting production functions, i.e. cotton and wheat yield, as well as profit. Therefore linear regression analyses were conducted. When carrying out regression analysis, profit from cotton and wheat was taken as dependent variables. Factors related to water supply are divided into three groups (A, B, C). Impact of these factors on production functions also vary for different groups. As results of analysis show, variable costs have more significant impact on production functions. Regression analysis of data was carried out by factors having direct impact on farmers production output. Calculation of correlation coefficient (R) was made on relation of specific profit to variable costs value, income and farm area:

$$P=f(\text{variable costs, income, area})$$

General coefficient of "B" group correlation on income variable cost volume-profit relationship and area for cotton was more than in other groups. $R= 0.998$. For wheat the coefficient was $R =0.721$, which is lower than in other groups. Regression analysis of results shows that variable costs have significant impact on efficiency of production process. Thus, in conditions of water deficiency water supply indices and partially desire to use ground water for irrigation should be considered as major factors having impact on production activity. Such factors as amount of applied fertilizers, soil quality (quality score attributed to land), and availability of adequate water for irrigation predictably have positive impact on yield and net profit. As could also be expected unsatisfactory state of drainage system, soil salinity and some other factors have detrimental effect.

Table 7. Results of regression data analysis in research areas of Fergana province

Crop	Functional dependence	Correlation coefficient (R)	R ²
	Canal irrigation		
Cotton	$Y = -44199.3 + 245.268*A + 0.945*I - 0.905*VC$	0.994	0.987
Wheat	$Y = -2687.165 - 193.996*A + 0.923*I - 0.963*VC$	0.986	0.973
	Pump irrigation		
Cotton	$Y = 7756.679 - 16566.8*A + 1.409*I - 1.323*VC$	0.985	0.971
Wheat	$Y = -16492.5 - 2141.044*A + 1.040*I - 1.034*VC$	0.993	0.987
	Ground water irrigation		
Cotton	$Y = 1135.958 + 2877.19*A + 0.882*I - 0.930*VC$	0.998	0.997
Wheat	$Y = -556122 + 21169.208*A + 0.784*VC$	0.721	0.631

Where Y – yield (t/ha) , VC - variable cost, I - income, A – area, P - profit (P) (in UZS).

1.5 Analysis of reasons of poor utilization of ground water for irrigation

Hydrogeological conditions of Furkat district farms require further addressing the issue of innovating water use in this area. In order to reclaim salt affected soils it is necessary to reduce ground water table through construction of new vertical wells. There are 46 vertical wells and their average depth is 20 m. During May-July four of these wells were functioning only. Only by December number of functioning wells increased to 7. Vertical wells of WUA “Yangi Dunyo Suv Yollari” belong to PSM (Pumping Stations Management Organization). Based on the agreement with Management of Pumping Stations (PSM) farmers cover their maintenance cost and use water for irrigation through authorization of district departments of irrigation systems management. Hydrogeological conditions of “Ahrorbek” farm, owner of which is Bahrom Hojakbarov (chairman of WUA allowed him to construct artesian well in 2002 at his own expense for 1 mln. UZS). Water from this well is being used by 2-3 farms. Depth of the well is 296 m, discharge is 7l/sec. Other farmers also attempted to construct such wells of 300 m depth, but due to high cost of construction (according to farmers – 29 mln. UZS) were not able to implement the same. Number of nonfunctioning reclamation wells in other research areas is considerable. Table 8 contains information on wells belonging to PESM by research areas.

Table 8. Information on vertical wells in the study areas

Districts	Total number of vertical wells	From them			
		Irrigation		Reclamation	
		Total	Functioning	Total	Functioning
Ahunbabaev	58	23	15	35	22
Rishtan	191	26	7	165	72
Furkat	46			46	7
Total in research areas	295	49	22	246	101
Percentage from total	100	17	45	83	41

As one can see from Table 8, from total number of vertical wells share of wells for irrigation is 17%, drainage wells is 83%. Specific weight of nonfunctioning wells for irrigation is 55 and for drainage needs is 59% of total. This results in raise of ground water table and causes deterioration of irrigated lands in the study area. There is a

shortage of funds for renovation of old nonfunctioning wells. Analysis of lost benefits because of defective wells was done based on data collected through the questionnaire.

The questionnaire included 14 questions for identifying the reason of not using ground water for irrigation. The result is given in Table 9. As can be seen from Table 9, 42 farmers answered the question whether they wanted to utilize subsurface water for irrigation positively and 25 farmers answered negatively, i.e. 63% of farmers showed desire to utilize ground water for irrigation. According to farmers opinion river water is enriched by sediments and they prefer to utilize it. Ground water is desilted and this is one of the reasons why some of the farmers refusing to utilize it for irrigation. Vertical wells on the research areas belong to PSM of district department of ISM (Irrigation Systems Management Organization). Small pumping stations and some vertical wells belonging to Pumping stations management are maintained by farmers on contract basis. Farmers cover all operation and maintenance costs. Cost of electric power and maintenance of pumps and wells is significant in the area of mechanical water supply. Farmers using pumps and vertical wells are exempted from water charges. According to farmers' answers 65 farmers highlighted expensive maintenance of wells, 61 farmers desired to use only subsurface water.

Table 9 - Analysis of reasons of not using ground water for irrigation

Answer	Availability of water	Able to utilize groundwater	Deep water level	Saline water	Permission to utilize ground water	Availability of wells	Would you like to construct a well	If there is a problem with fuel	Availability of electric power transmission lines	Able to use well	Expensive maintenance of wells	Do you use subsurface water by turn	Would you like to utilize only subsurface water	Would you like to utilize ground water
Natural flow														
Yes	26	24	6	8	30	0	13	25	13	14	33	34	30	16
No	8	10	28	26	4	34	21	9	21	20	1	0	4	18
Pump														
Yes	1	10	3	2	10	5	5	1	10	7	23	24	24	19
No	23	14	21	22	14	19	19	23	14	17	1	0	0	5
Well														
Yes	5	7	1	2	9	9	5	1	7	3	9	9	7	7
No	4	2	8	7	0	0	4	8	2	6	0	0	2	2
Total														
Yes	32	41	10	12	49	14	23	27	30	24	65	67	61	42
No	35	26	57	55	18	53	44	40	37	43	2	0	6	25

II. Barriers on utilization of ground water for irrigation in South Kazakhstan

In Kazakhstan in early 90s of the last century almost 6% (over 2.3 mln.ha) of total arable land was irrigated and about third part (in southern part over 75%) of crop production was obtained on irrigated land. Such high profitable crops as cotton, sugar beat, rice, vegetables and others are cultivated on irrigated cropland, and grain productivity under irrigation is 2-3 times higher than on rainfed land.

Major issues in water management in Southern Kazakhstan could be summarized as follows:

- Lack of actual basin programs on water management;
- Small farming system with poor financial potential;
- Unsatisfactory quality of irrigation water;
- Lack of water use accounting;
- Considerable deterioration of irrigation and drainage systems;
- Severe reduction of human capacity building (training of specialists) on saline soil amelioration and water management.

Existing drainage system was created for large irrigation projects. Creation of numerous, almost quite independent water users on irrigated area has brought deterioration of irrigation and drainage systems. Status of irrigated farming during the last years is characterized by essential changes: technical level of reclamation objects has been getting worse, productivity has been reducing and large areas of irrigated land have been falling out of rotation. Only 1.42 mln. ha of earlier irrigated land (of 2.35 mln.ha , total) were used and only 1.2 ha area is being irrigated.

Currently there is about 115 thousand ha of saline land in the Republic, of which 8 thousand ha is highly, 25 thousand ha is moderate and 82 thousand ha is slightly saline. Moreover, salinity increase is indicated on almost 200 thousand ha of earlier reclaimed and developed land. Excessive salinity of soil results in excessive use of irrigation water and costs extra expenditures for farmers to produce relatively good yield. It is known that on soils with low degree of salinity cotton yield loss is between 15-20%, on soils with medium degree of salinity yield loss is 50-80%, and on alkaline soils crop is completely damaged.

Drainage system on irrigated lands consists of open drains and vertical wells which are constructed to maintain ground water table below critical depth. Currently actual depth of open drainage is 1.5-2.0 times less than designed and most of the wells are not functioning. Naturally this affects to salinity level of irrigated lands and requires reconstruction of irrigation and collector-drainage net.

2.1 General information: village Eski Ikan, Turkestan district of Southern Kazakhstan province

First stage of socio-economic survey was implemented in Turkestan district, South Kazakhstan province in village “Eski Ikan”, which located in command area of Arys-Turkestan canal. *Arys-Turkestan irrigation massive* is part of *Arys-Turkestan irrigation area*. This is an area of ancient irrigation, occupying large territory of over 17 thousand km². Irrigated area stretches from south-east to north-west and it is 250 km lengthwise and its width is between 40 and 100 km.

Irrigated area in the zone of Arys-Turkestan canal (ATC) covers Ordabasyn and Turkestan districts of South Kazakhstan province. Development of the area began in 1961. Length of ATC is 140 km, its head discharge is 45 m³/s. Total irrigation area is over 70 thousand ha, including 60 thousand ha of regular irrigation. Over 700 km of open and 770 km of closed drainage net was constructed in irrigation area. Major direction of farming is cotton growing and viniculture. Livestock breeding is also developed.

Turkestan district covers 7.4 thousand km², which is 6.3% of South Kazakhstan province. As of 1 January 2004 population of the district was 186.7 thousand people, 49.3% of which is urban population and 50.7% is rural population. 6.7 % of province agricultural output is produced in this district. Cotton growing dominates in agricultural production – 33.8%, meat production share is 20.2%, milk – 15.6% and vegetables – 8.9%. Cotton area has been increasing during last years; in 2004 it was 49.5% of all cropping area.

2.2 Results of sociologic studies

Major objective of this research is to improve productivity of land by applying ground water for irrigation. One of the reasons of reduction of productivity of irrigated land is poor status of on-farm and inter-farm drainage systems. Land productivity goes down due to malfunctioning and breaking of pump drainage wells, shortage of irrigation water, poor maintenance of drainage systems. It has been known that low degree of soil salinity reduces yield to 20%, medium degree of salinity reduces to 20-50% and high degree of salinity reduces yield to 50-75%, sodic soils have poor physical properties. According to calculations, due to soil salinity the state loses 70-100 thousand tons of raw-cotton and almost 70 thousand tons of wheat grain annually. Crop products on saline soils are always have poor quality. Therefore development of methods on combating effect of soil salinization or its prevention is very important, especially methods that could be introduced under current farming practices.

Socio-economic survey on identification of barriers on utilization of ground water for irrigation was conducted in Turkestan and Mahtaaral districts of South Kazakhstan.

In village Old Ikan the survey was conducted among 42 farmers and the results showed that only 5 farms have functioning wells. The sociologic survey in Eski Ikan farm proved that:

- 38% of respondents would like to use ground water if water is available;
- 36% would like to use ground water but do not have funds to cover power cost;
- 9.5% of respondents use ground water once in the end of irrigation season when canal water is in shortage;
- 2.3% of respondents use ground water 2-3 times per year in the end of the irrigation season;
- 14.2% of respondents sad that have no funds to rehabilitate wells or power supply.

Table 10. Vertical wells (village Old Ikan, 2005)

#	Name	Number of wells	Availability of transformer	Location	Assigned to
1	Srashev Tahir	3	n/a	P-26	ИК Umid-4
2	Srashev Tahir	1	n/a	P-23	ИК Umid-4
3	Muborakov Nabihan	1	n/a	P-24-1	Nabihan
4	Abdiev Raim	1	n/a	P-28-1	Abdiev R
5	Usmankulov Kamilhan	1	Available	P-25-3	Usmankulov K
6	Ahmedov Musa	3	n/a	P-25-2	Ahmedov M
7	Ataev Rinat	1	Available	P-25-1	Ataev R
8	Mannatov Donish	1	Available	P-25-5	Mannatov D
9	PC Samsonova	1	Available	P-25-4	PC Samsonova
10	Ahmedov Abdukahhar	1	n/a	P-23-13	Ahmedov A
11	JSC “Yassi”	2	n/a	P-23-3	JSC “Yassi”
12	Saydikramov Hudiyar	2	Available	P-23-4	Saydikramov H
13	Sharapova Ilmora	1	n/a	P-23-12	Sharapova I
14	Mavlyanov Alish	1	n/a	P-23-6	Mavlyanov A
15	Tursunhodjaev Arif	1	Available	P-23-9	Tursunhodjaev A

16	JSC “Yassi” dep. # 4	1	Available	P-23-0	JSC “Yassi”
17	Sharapov Gafur	2	n/a	P-23-5	PIK “Eski Ikan”
18	Razikov Rustam	1	n/a	P-25-6	Razikov R
19	Srashev Aynitdin	1	Available	P-25-10	Srashev A
20	Mamadaliyev Nuzur	2	n/a	P-25	Mamadaliyev N
21	Abdusattarov Yuldash	1	n/a	P-25-9	Abdusattarov Yu
22	Kuchkarov Kahramon	7	n/a	P-28-6,7,8	JSC “Yassi”
23	Adeshov Rustam	1	n/a	P-24-2	Adeshov R
24	Kasimov Adilhan	1	n/a	P-27-17	Kasimov A
25	Mavlyanov Rahmon	1	n/a	P-28-8	Mavlyanov R
26	JSC “Yassi”	1	Available	P-26	Central bulk plant
27	Kuchkarov Kahramon	3	Available	P-28	JSC “Yassi”
28	Mannatov Haldin	1	n/a	P-28-9	Mannatov H
29	Saydikramov Abdulla	2	n/a	P-28-10,12	Saydikramov A
30	Siddiqov Abdulla	1	n/a	P-28-11	PIK “Arman”
31	Makkambaev Yuldash	1	Available	P-24-16	Makkambaev Yu
32	Ergeshov Ismail	1	Available	P-23-1	Ergeshov I
33	Satibaldiev Nadir	1	Available	P-23-15	Satibaldiev N
34	Kasimov Muborak	1	n/a	P-24-4	Kasimov M
35	Muhamedjanov Tulkin	1	n/a	P-25-18	Muhamedjanov T
36	Mamatsadikov Tashpulat	1	n/a	P-25-12	Mamatsadikov T
37	JSC “Yassi”	2	n/a	P-24	PIK Yusuf ata
38	JSC “Yassi”	2	n/a	P-25-10	Shadibekov R
39	JSC “Yassi”	1	n/a	P-24	Garj # 3
40	Babaev Zait	1	n/a	P-23	Babaev Z
41	Niyazkulov Urintay	2	n/a	P-28-18,19	Dep. # 2

The survey proved that over 70% of the respondents would like to use ground waters of which 20.7% during the whole irrigation season and rest in the end of the summer when shortage of canal water for irrigation. The main barriers for ground water use for irrigation are high cost of rehabilitation of wells and power supply. Individual small farmers do not have free funds to investigate for recovery of vertical wells.

Socio-economic survey in Mahtaara district showed that 71% of questioned farmers grow cotton, 29% of farms combine cotton with other crops – maize for grain and silage, vegetables, melons and alfalfa. In Turkestan district 89% of questioned farmers grow only cotton, 11% of farms combine cotton with small plots of other crops, such as maize for grain and silage, vegetables, melons and alfalfa.

In village Besketik of Makhtara district, the survey was conducted among 37 farmers, all of them indicated that they have access to ground water, vertical wells are functioning and maintaining ground water table below critical level. They are not using ground water for irrigation because of high salinity, above 4 g/l.

III. Conclusions and recommendations

The sociologic survey in Fergana province of Uzbekistan and Southern Kazakhstan identified the following barriers for ground water use for irrigation:

1) In Fergana province:

High maintenance cost of vertical wells and high cost of electricity is the main barrier for wide use of ground waters for irrigation. This is when farmers pay for WUA canal water delivery services, only. Farmers do not pay for water delivery through main canals to Canal Water

Organizations (CWO), services of CWO is free for water users. Another barrier is that farmers no have freedom in selection of crops, most of the irrigated area is under cotton and wheat. This reduces income of farmers and their free resources to install new wells or cover maintenance expenses of existing one. Even in these conditions 61% of respondents desired to use ground water for irrigation.

2) In Southern Kazakhstan, there are two different zones, Arys Turkestan Canal (ATC) command area, with relatively good quality of ground water and Makhtarl district which is tail part of transboundary canal Dustlik, where ground water salinity is above 4 g/l. The survey in ATC zone proved that most of the wells are out of operation and state support is required to rehabilitate them. Over 70% of respondents are indicated their interest to use ground water for irrigation during the whole irrigation season or in conjunctive with canal water. State credit lines to farmers aimed to rehabilitate wells for abstraction of ground waters for irrigation needs can significantly improve water supply of farms of ATC command area. In Makhtarl district, located in the tail part of Dustlik canal farmers did not show interest to apply ground water for irrigation due its poor quality and high cost. One of the reasons of this is shallow ground water table in spring contributing to crop water supply in April – June and that way ensuring cotton production at 2-2.5 t/ha based on sub-irrigation requiring no cost for water delivery. However, this approach with time may build up salinity in the top-soil.

2) Conducted socio-economic survey proved that when relatively good ground water quality is available farmers would like to ground water for irrigation. Proper water management and agricultural policies can contribute to increasing areas of ground water use for irrigation. This way surface water can be saved and transferred to the areas with ground waters having poor quality.

APPENDIX 1 - QUESTIONNAIRE USED TO IDENTIFY BARIERS TO GROUND WATER USE FOR IRRIGATION

Date: _____

Name of the Interviewer: _____

1. Name of the farmer (water user):	
2. House name/Number	3. Street
4. Village:	5. District:
6. State	7. The year of becoming farmer
8. Specialization of the farmer:	9. Interviewer:

Land holding (Area in Hectare)

10. Land details	10.1 Total farm size	10.2 Total cultivated area	10.3 Total Irrigated Area
Area (Hectare)			

11. Area Cropped once in a Year (Hectare)	12. Area Cropped twice in a Year (Hectare)	13. Area Cropped three times in a Year (Hectare)

14. Property status:	Area (ha)	Renting period
a) Deqkhan farm, rent for long lease		
b) rent for short-term lease		
c) Presidential land		
d) Kitchen-garden		
e) other		

15. Irrigated lands reclamation condition	
soil type	
bonitate mark	
waterlogged	
avarage salinity	
high salinity	

16. Ground water level:	
on the land surface	%
0,5-1 meter	
1-3 meter	
more then 3 meters	
mineralization	

17. Rights for water use	
The date of becoming a member to WUA	
Name of WUA (water user association)	
Is there an agreement for water supply btw WUA	
Water use per year, meter ³	
Water use for main crop, meter ³ per year	
Land use efficiency for WUA, %	
Irrigation efficiency (factor) for WUA, %	
on whose balance vertical wells	

18. Irrigation system of farmers		
Irrigation system:	length	
outlets		
closed collector-drainage system		
opened collector-drainage system		
vertical well		

Your source of irrigation and area irrigated by source (ha)

19. Rainfed	20. Only Canal	21. Only own Well/Tubewell	22. Canal & Well/Tubewell	23. Pump irrigation from canal	24. Other Source (Pl. specify)

Wells/Tubewells Statistics

25. How many Wells/Tubewells do you have?				
25.1 Total Number	25.2 Functional	25.3 Abandoned	25.4 Electric pumps	25.5 Diesel pumps

25.6. In whose balance belongs the wells?

a) Own balance	b) Balance of WUA	c) Balance of District WMO	d) others

26. The reasons of not using of ground water		
No		+,-
1.	Sufficiency of water resources	
2	Can't use the ground water	
3	Deep level of ground water	
4	Salinity level of ground water	
5	Using is not allowed	
6	The well is not available	
7	Do you have any problems with fuel availability?	
8	If the electricity lines are available	
9	Doesn't know how to use well	

10	Think that well expenses are too expensive	
11	Do you use surface water by putting your self on a waiting list	
12	Do you want to use only surface water for irrigation?	
13	Do you want also use the ground water for irrigation?	

27. Crop Statistics

Which are the main crops you irrigated with your well/tubewell during the past 12 months?

Name of the crops	Season	Area (Ha)	Number of watering from TW only	Hours needed to irrigated 1 Ha	Yield per Ha	Price per Quintal.	Technology for water application*
1.							
2.							
3.							
4.							
5.							

*: 1. Flood Irrigation 2. Check Basin 3. Drip Irrigation 4. Sprinkler 5. Furrow Irrigation 6. Others (Pl. specify)

28. Family budget		
purpose	thousand sum	
	Income	Expenses
Foodstuff		
Clothing		
Other payments:		
Public utilities:		
Taxes:		
Transport costs		
Costs for health recovery		
Education		
Different ceremonies		
Pension		
Salary		
Animals		
Garden (summer residence)		
Total		
Difference:		
do you have additional funds available		

29. Family labour power				
	Adults (in the age of 15 to 65)	Pensioners (older then 65 year)	Teenagers (in the age of 9 to 15)	Children (until 9 year's old)
Man				
Woman				

30. Structure of farm's income per year					
	Quantity		Price per item, sum	Income , thousand sum	Percentage wise (%)
	sold on the market	used for family			
Livestock					
Wool, kg					
Meat, kg					
Milk, liter					
Sour milk, liter					
Poultry, heads					
Eggs, items					
wheat, kg					
Fruits, kg					
Vegetables, kg					
Renting of equipments					
Other					
Salary, sum/ year					
Social security					
Pension					
Total:					

31. Cultivated area :													
Crop pattern	Area, ha	Planned		Actual		State order		Purchasing price, sum per kg				Sale proceeds (earnings), thousand sum	
		Yield centner per ha	Total yield, ton	Yield, centner/ha	Total, ton	Planned, tones	Actual fulfillment of state order, ton	Retail price	Wholesale price	Free price	Private consumption	Total	From 1 ha
Cotton													
Wheat													
Rice													
Orchards													
Vineyard													
Maize with wheat													
Maize and silage													
Potato													
Carrot													
Melons and gourds													
Other crop													

32. Direct costs/expenses of farmer/water user							
	Own production, kg	Bought from market, kg	Governmental supply	Kg for 1 ha	Total needed kg	Cost for 1 kg, sum	Total cost, sum
Seeds							
Cotton							
Wheat							
Maize for wheat							
Maize for silage							
Rice							
Potato							
Carrot							
Melons and gourds							
Peas							
Alfalfa							
Beet							
Fertilizers							
Manure							
Nitre ammonia							
Ammophos							
Chemical substances							
Herbicides							
Insecticide							

Labour cost					
Activity type	Workers number	Unit of measure	Cost per unit	Total cost	Cost for 1 ha, sum
Own					
Hired					

33. Machinery and equipment expenses of farmer/water user							
	Type of the equipment/ machinery		cost per unit of done work		Cost for total area		
	Own	Rent	Unit of measure	Price	Area, ha	Total expenses, sum	Expenses for 1 ha, sum
Tillage (without fuel)							
Harrowing							
Chisel plow							
Furrow cutting							
Sowing							
Seeds transportation							
Furrow cutting							
1- cultivation							
Fertilizer transportation							
2- cultivation							
Furrow cutting							
3-cultivation							
For harvesting							
For transport							
Total							

34. Operating expenses				
Running costs	Quantity			
Irrigation methods:				
a) surface water				
b) drainage water				
c) ground water				
Total volume of supplied water, m ³ (cubic metre)				
Including for main crop				
Water use for 1 ha of land, m ³ (cubic metre)				
Water flushing, m ³				
Quantity of pouring, watering				
Expenses on the main crop				
Cost for water flusing, sum per ha				
Prime cost of 1 cubic metre of water from the main canal, sum				

Coefficient of efficiency of irrigation system				
Farmer expenses for the cleaning of the irrigation system, sum per ha				
Government expenses for cleaning of irrigation system, sum per ha				

35. Operating expenses for electricity, kw				
Cost per unit				
Total cost				
Salary of pourer				
Unit				
Cost per unit				
Total cost				

36. Fixed costs				
Costs item	Unit of measure	Cost, sum		
		Per unit	Total	For 1 ha of land
amortization				
payment for surface water use				
payment for ground water use				
Rent				
Insurance				
Cleaning of drainage system				
Tax for real estate				
Rent of land				
Administrative costs				
Total fixed costs				

Appendix 2. Socioeconomic survey summary

1. General information		2. Land resources				3. Soil data		
Name of farm	Year of farm establishing	total area	cropping area	Land use efficiency	Soil quality (Bonitet)	waterlogged,	Moderate saline area	Highly saline area
		ha	ha				ha	
Madrahimova Mavludahon	2005	10.7	10	0.93	42		10.7	
Istiqloq zamini	2003	25.2	15.6	0.62	62		14.6	
Botirbek	2006	55.2	52.6	0.95	60			
Askarhoji	2006	29.4	26.4	0.90	60		26.4	
Alijon Ashurovlar Sahovati	2006	12.3	10.9	0.89	60			
Baraka	1994	30	28.5	0.95	47.5		1	
Hamidullo Hikmatullo Kozokovlar	2004	102.3	96.2	0.94	80	48.1		
Akmal	1993	104	97.9	0.94	70		40	
Bahtiyor Otajonov	1994	16.2	15.9	0.98	40		4	9
Shahboz	2000	11.2	10.7	0.96	40		10.7	
Al-masad	1996	19.9	19	0.95	40		19	
Ruzmatjon	1999	17.6	16.1	0.91	54			
Otahujaevlar	2000	10.6	10	0.94	40		5	5
Ibrohim	2001	12	11.6	0.97	46	5.8	2.3	3.5
Donishmand	2000	14.3	13	0.91	40			
Muhiddinjon	2000	56.3	56	0.99	65		56	
Akbarjon	1998	15.1	14.8	0.98	40		6	8.8
Ishonch	2000	17.3	16.5	0.95	40	8	8.5	
Muazam	2000	10.1	9.7	0.96	40			9.7
Aziza Mutasarbonu	2004	10.4	10.4	1.00	40		7.4	3
Baht	1996	10	9.9	0.99	40		10	

Gulhumor qizlar	1994	22.8	20.5	0.90	60		22.8	
Mahamadjon 2	1994	50.9	48	0.94	60		50.9	
Shukurullo Ibrohimov	2005	18.7	17.2	0.92	42			
Vositjon	1996	40.2	40	1.00	60			
Abdullajon Toshmatov	2005	20.2	18.7	0.93	70	8	10	
Inom Ganiev	2004	29.3	28.1	0.96	55	28.1	0	0
Fazilathon Bohodirjon zamini	2004	15.8	13.9	0.88	55		2	7
Ihtiyorjon Zohidjon ogli	2005	11.6	11.3	0.97	56		11.3	
Eldorjon Rahimov	2005	23.8	20	0.84	60		4	1.8
Munavar Yulduz zamini	2004	18.4	15.4	0.84	54			
Madinabonu Matluba qizi	2005	10	10	1.00	56			
Davranboy ogli Azizbek	2005	12	12	1.00	55			
Hakimjon ogli Rustam	2005	12.9	12.5	0.97	55			
Mamasidiq ota	2005	16.2	16	0.99	56			
Izzat Ibrohimov	2005	15.1	15.1	1.00	55		0.4	0.6
Suhrobjon Subhonjon	2005	2	2	1.00	56		0.9	0.1
Sharofathon Alisher	2005	23.9	23.9	1.00	55.6		10	13.9
Anvar Siddiw zamini	2005	13.1	13.1	1.00	60		x	x
Kahramon	2005	20.3	20.3		56		10	10
Ahillikda baraka	2004	28.1	28		60		28	
Buyuk halifa	2004	12.6	12.6		55		0.8	0.2
Tkuay Gavhari	2005		11.9		56		0.8	0.2
Rustamjon ogli Hakimjon	2005		12.9		56		1	
Halifai davron	2005	32.3	31.8		54			
Irrigator Obidjon	2005	22	20	0.91	72		10	4
Abdullajon ota Nurmatov	2005	11.2	10.6	0.95	45		10.6	
Kandiniso aya	2002	22	18	0.82	42	8	10	
Ahrorbek	1995	18.6	18.1	0.97	65		18.1	
Rahmonberdi ota	1993	21.5	17	0.79	50	7	10	

Dadaboy	1996	12.9	10.7	0.83	49		12.9
Tolibjon Dehqonov	2002	14.5	14.3	0.99	65		14.5
Kodirjon Nasredinov	1997	13.85	13.6	0.98	74		13.85
Elmurod	2002	15.3	15	0.98	77		15.3
Shams	2002	16	15.5	0.97	44		16
Mashrabov Tolibjon	2002	10.2	10	0.98	50		
Ilesbek Ilhomjon	2002	12.2	12	0.98	65		
Yunusali ota Begmatov	1995	12.15	12	0.99	65		
Shodiboy ota	1998	10	9.8	0.98	65		10
Nurmatboy ota	1998	14.8	14.5	0.98	65		14.8
Munis ona	2002	9	8.8	0.98	46		
Bahodir Tursunov	2002	10.9	10.7	0.98	65		10.9
Lola	2002	9.65	9.4	0.97	55		9.65
Sheravazbek (Rustamjon Koraboev)	1996	8	8	1.00	65		8

Continuation

1. General information	
Name	
Madrahimova Mavludahon	
Istiqlof zamini	
Botirbek	
Askarhoji	
Alijon Ashurovlar Sahovati	
Baraka	
Hamidullo Hikmatullo Kozokovlar	
Akmal	
Bahtiyor Otajonov	
Shahboz	
Al-masad	
Ruzmatjon	
Otahujaevlar	
Ibrohim	
Donishmand	
Muhiddinjon	
Akbarjon	
Ishonch	
Muazam	
Aziza Mutasarbonu	
Baht	
Gulhumor qizlar	

4. Ground water table (June), %:

< 0.5 m	0,5-1 m	1-3 m	more than 3 m
			100
		100	
		100	
		100	
	40	60	
		100	
		100	
	60	30	10
			100
		100	
	100		
	100		
		100	
			100
	100		
		100	
	100		
		100	
		100	

Mahamadjon 2			100	
Shukurullo Ibrohimov				100
Vositjon				100
Abdullajon Toshmatov		43		57
Inom Ganiev	0	0	100	0
Fazilathon Bohodirjon zamini				100
Ihtiyorjon Zohidjon ogli			100	
Eldorjon Rahimov		7.5	16.8	65.5
Munavar Yulduz zamini				100
Madinabonu Matluba qizi			100	
Davranboy ogli Azizbek			100	
Hakimjon ogli Rustam			100	
Mamasidiq ota			100	
Izzat Ibrohimov				100
Suhrobjon Subhonjon				100
Sharofathon Alisher				
Anvar Siddiw zamini				100
Kahramon				100
Ahillikda baraka				100
Buyuk halifa				100
Tkuay Gavhari				100
Rustamjon ogli Hakimjon			100	
Halifai davron				100
Irrigator Obidjon			100	
Abdullajon ota Nurmatov		100		
Kandiniso aya		100		
Ahrorbek		100		
МЭИБ Rahmonberdi ota				100
Dadaboy			100	
Tolibjon Dehqonov			100	

Kodirjon Nasredinov	100	
Elmurod	100	
Shams		100
Mashrabov Tolibjon		100
Ilesbek Ilhomjon	100	
Yunusali ota Begmatov	100	
Shodiboy ota		100
Nurmatboy ota		100
Munis ona	100	
Bahodir Tursunov		100
Lola	100	
Sheravazbek (Rustamjon Koraboev)	100	

Continuation

Name	8. Reasons of not utilizing ground water					
	No water shortage	doesn't know how to use	deep water table	saline water	no permission	no wells
Madrahimova Mavludahon	yes	yes	yes	no	available	n/a
Istiqlol zamini	yes	yes	yes	no	available	n/a
Botirbek	yes	no	no	yes	available	n/a
Askarhoji	yes	no	yes	no	available	available
Alijon Ashurovlar Sahovati	no	no	yes	no	available	available
Baraka	no	yes	no	no	available	n/a
Hamidullo Hikmatullo Kozokovlar	no	yes	no	no	available	available
Akmal	no	yes	no	no	available	available
Bahtiyor Otajonov	no	yes	no	no	available	n/a
Shahboz	yes	can	yes	no	n/a	n/a
Al-masad	no	can	no	no	available	n/a
Ruzmatjon	yes	can	no		available	n/a
Otahujaevlar	yes	can	no	no	available	n/a
Ibrohim	yes	can	no	yes	available	n/a
Donishmand	yes	can	no	yes	available	n/a
Muhiddinjon	yes	can	no	yes	available	n/a
Akbarjon	yes	can	no	no	available	n/a
Ishonch	yes	can	no	no	available	n/a
Muazam	no	can	no	no	available	n/a
Aziza Mutasarbonu	yes	can	no	no	available	n/a
Baht	no	can	no	no	available	n/a
Gulhumor qizlar	no	can	no	doesn't know	available	n/a

Mahamadjon 2	yes	no	no	no	doesn't know	n/a
Shukurullo Ibrohimov	yes	no	yes	no	n/a	n/a
Vositjon	yes	can	yes	no	available	n/a
Abdullajon Toshmatov	no	yes	no	no	available	available
Inom Ganiev	no	yes	no	yes	available	n/a
Fazilathon Bohodirjon zamini	no	no	no		available	n/a
Ihtiyorjon Zohidjon ogli	no	yes	no	no	available	available
Eldorjon Rahimov	no	cannot	no	yes	available	available
Munavar Yulduz zamini	no	yes	yes	no	n/a	n/a
Madinabonu Matluba qizi	no	yes	no	no	n/a	n/a
Davranboy ogli Azizbek	no	no	no	no	n/a	n/a
Hakimjon ogli Rustam	no	no	no	no	n/a	n/a
Mamasidiq ota	no	no	no	no	n/a	n/a
Izzat Ibrohimov	no	no	no	no	n/a	n/a
Suhrobjon Subhonjon	no	no	no	no	n/a	n/a
Sharofathon Alisher	no	no	no	no	n/a	n/a
Anvar Siddiw zamini	no	no	no	no	n/a	n/a
Kahramon	no	no	no	no	n/a	n/a
Ahillikda baraka	no	no	no	no	n/a	n/a
Buyuk halifa	no	no	no	no	n/a	n/a
Tkuay Gavhari	no	no	no	no	n/a	n/a
Rustamjon ogli Hakimjon	no	yes	no	no	available	available
Halifai davron	no	yes	yes	no	n/a	n/a
Irrigator Obidjon	no	yes	no	no	available	n/a
Abdullajon ota Nurmatov	yes	yes	no	no	available	n/a
Kandiniso aya	yes	yes	no	no	available	n/a
Ahrorbek	yes	can	no	no	available	available
Rahmonberdi ota	yes	can	no	no	available	n/a
Dadaboy	yes	no	no	no	available	n/a

Tolibjon Dehqonov	yes	can	no	no	available	n/a
Kodirjon Nasredinov	yes	can	no	doesn't know	available	n/a
Elmurod	yes	can	no	doesn't know	available	n/a
Shams	little	did not use	no	doesn't know	available	n/a
Mashrabov Tolibjon	yes	no	yes	doesn't know	available	n/a
Ilesbek Ilhomjon	yes	no	no	no	available	n/a
Yunusali ota Begmatov	yes	can	no	no	available	available
Shodiboy ota	almost	no	no	no	doesn't know	n/a
Nurmatboy ota	almost	no	no	doesn't know	available	n/a
Munis ona	almost	can	no	yes	available	n/a
Bahodir Tursunov	yes	can	3 m	no		n/a
Lola	yes	no	no	yes	available	n/a
Sheravazbek (Rustamjon Koraboev)	yes	yes	no	no	available	available

Continuation

1. General information								
Name	would you like to construct a well	is there a problem with fuel	availability of power transmission lines	can not use a well	costly maintenance of wells	do you use surface water by turn	would you like to use surface water	would you like to use ground water
Madrahimova Mavludahon	yes	expensive	n/a	yes	yes	yes	yes	yes
Istiqlol zamini		no	n/a	yes	yes	yes	yes	yes
Botirbek	yes	yes	n/a	can	yes	yes	no	yes
Askarhoji	no	no	available	no	yes	yes	yes	yes
Alijon Ashurovlar Sahovati	no	yes	available	no	yes	yes	yes	yes
Baraka	yes	no	available	can	yes	yes	no	yes
Hamidullo A41 Kozokovlar	yes	no	available	can	yes	yes	yes	yes
Akmal	no	yes	available	can	yes	yes	yes	yes
Bahtiyor Otajonov	no	yes	available	can	yes	yes	yes	yes
Shahboz	no	no	n/a	can not	no	yes	yes	no
Al-masad	no	yes	n/a	can	yes	yes	yes	no
Ruzmatjon		expensive	available	can not	yes	yes		no
Otahujaevlar	no	expensive	n/a	can not	yes	yes	yes	no
Ibrohim	no	expensive		can not	yes	yes	yes	no
Donishmand	no	expensive	available	can not	yes	yes	yes	no
Muhiddinjon	no	expensive	available	can not	yes	yes	yes	no
Akbarjon	yes	expensive	n/a	can not	yes	yes	yes	no
Ishonch	no	expensive	n/a	can not	yes	yes	yes	no
Muazam	no	yes	n/a	can not	yes	yes	yes	no
Aziza Mutasarbonu	no	no	available	can not	yes	yes	yes	

Baht	no	yes	n/a	can	yes	yes	yes	no
Gulhumor qizlar	yes	expensive	n/a	no	yes	yes	yes	yes
Mahamadjon 2	no	yes	available	no	yes	yes	yes	no
Shukurullo Ibrohimov	no	yes	available	no	yes	yes	yes	no
Vositjon	yes	no	available	can	yes	yes	yes	yes
Abdullajon Toshmatov	yes	no	available	yes	yes	yes	yes	no
Inom Ganiev	yes	no	available	no	yes	yes	yes	no
Fazilathon Bohodirjon zamini	no	no	available	can	yes	yes	yes	no
Ihtiyorjon Zohidjon ogli	no	no	available	can	yes	yes	yes	yes
Eldorjon Rahimov	yes	no	available	can	yes	yes	yes	yes
Munavar Yulduz zamini	no	no	n/a	can not	yes	yes	yes	no
Madinabonu Matluba qizi	no	no	n/a	can not	yes	yes	yes	yes
Davranboy ogli Azizbek	no	no	n/a	can not	yes	yes	yes	yes
Hakimjon ogli Rustam	no	no	n/a	can not	yes	yes	yes	yes
Mamasidiq ota	no	no	n/a	can not	yes	yes	yes	yes
Izzat Ibrohimov	no	no	n/a	can not	yes	yes	yes	yes
Suhrobjon Subhonjon	no	no	n/a	can not	yes	yes	yes	yes
Sharofathon Alisher	no	no	n/a	can not	yes	yes	yes	yes
Anvar Siddiw zamini	no	no	n/a	can not	yes	yes	yes	yes
Kahramon	no	no	n/a	can not	yes	yes	yes	yes
Ahillikda baraka	no	no	n/a	can not	yes	yes	yes	yes
Buyuk halifa	no	no	n/a	can not	yes	yes	yes	yes
Tkuay Gavhari	no	no	n/a	can not	yes	yes	yes	yes
Rustamjon ogli Hakimjon	no	no	available	can	yes	yes	yes	yes
Halifai davron	no	no	n/a	can not	yes	yes	yes	no
Irrigator Obidjon		no		no	no	yes	yes	yes
Abdullajon ota Nurmatov	yes	no	n/a	no	yes	yes	yes	yes

	yes, if all the cost is covered by state							
Kandiniso aya		no	available			yes	yes	yes
Ahrorbek		no	yes	no		yes	yes	yes
Rahmonberdi ota	yes		n/a	no	no	yes	yes	yes
Dadaboy	no	no	n/a	no	doesn't know	yes	yes	no
Tolibjon Dehqonov	yes	no	n/a	yes	yes	yes	yes	yes
Kodirjon Nasredinov	yes	no	n/a	no	yes	yes	no	yes
Elmurod	yes	no	n/a	no	yes	yes	no	yes
Shams	yes	yes	n/a	no	yes	yes	yes	no
Mashrabov Tolibjon	no	no	n/a	no	yes	yes	yes	no
Ilesbek Ilhomjon	no funds	expensive	yes	no	yes	yes	yes	yes
Yunusali ota Begmatov	no	no	n/a	can not	yes	yes	no	yes
Shodiboy ota	yes	yes	n/a	can not	yes	yes	yes	yes
Nurmatboy ota	yes	expensive	n/a	can	yes	yes	yes	yes
Munis ona	no	yes	n/a	can	yes	yes	yes	yes
Bahodir Tursunov	yes	expensive	n/a	can	yes	yes	yes	yes
Lola	no	yes	available	can	yes	yes	yes	no
Sheravazbek	no	yes	available	can not	yes	yes	no	yes

Continuation

1. General information	13. Cropping area, ha				14. Real yield, c/ha		
	Name	cotton	wheat	aftercrop	cotton	wheat	aftercrop
				maize			other
Madrahimova Mavludahon	5	5	-	-	30.5	35	-
Istiqlol zamini	5.6	10	-	-	28	35	-
Botirbek	30.4	22			30.5	45	
Askarhoji	16.4	10			29.5	45	
Alijon Ashurovlar Sahovati		10.9				41	
Baraka	16.4	11.9	5	5	26.6	43	
Hamidullo Hikmatullo Kozokovlar	50.2	46			25	50.7	
Akmal	35.2	32	30	0.7	33	45.8	200
Bahtiyor Otajonov	10.9	4			27	48	
Shahboz	6.7	4			26	41.5	
Al-masad	9	10			26	40	
Ruzmatjon	6	11			26	38.9	
Otahujaevlar	6	4			26	42.5	
Ibrohim	7.1	4.5			25.6	40.4	
Donishmand	7	6			27	40	
Muhiddinjon	45	15	20		32	52	200
Akbarjon	8.8	4			28	42.5	
Ishonch	9.5	7			25.7	35	
Muazam	9.7	4			27	38	
Aziza Mutasarbonu	6.4	4		1.5	25.3	40	
Baht	0	9.7				38	
Gulhumor qizlar	6.5	14			28	40	
Mahamadjon 2	16.4	31.6			29	44	
Shukurullo Ibrohimov	7.2	10			30	48.4	

Vositjon	30	40			30	48	
Abdullajon Toshmatov	9.5	9.2			26	45	
Inom Ganiev	17.4	10.7	1.5		26.4	50	200
Fazilathon Bohodirjon zamini	7	6	3		35.78	61.56	
Ihtiyorjon Zohidjon ogli	5.3	5.7	2		26	52	100
Eldorjon Rahimov	11.7	8.3		3.5	29	52	
Munavar Yulduz zamini	9.2	6.2	2		32	53	
Madinabonu Matluba qizi	5.6	4.4	2		26	52	200
Davranboy ogli Azizbek	7	5	2		25	50	187
Hakimjon ogli Rustam	7.7	5.2	2		25	50	190
Mamasidiq ota	10.2	6	3		26	50	200
Izzat Ibrohimov	10.7	4.4			26	52	
Suhrobjon Subhonjon		1		1		50	250
Sharofathon Alisher	14.9	9			25	50	
Anvar Siddiw zamini	7.7	5.4			26	52	
Kahramon	13.3	7			25	50	
Ahillikda baraka	17	11			26	50	
Buyuk halifa	2.6	10			25	50	
Tkuay Gavhari	4.9	7			25	50	
Rustamjon ogli Hakimjon	9.4	3.5			26	32	
Halifai davron	19.3	13			32	53	
Irrigator Obidjon	10	10	3		31	40	200
Abdullajon ota Nurmatov	5.1	5.5			28	40	0
Kandiniso aya	9	9			26.5	31	
Ahrorbek	8.1	10	5		30.25	31	5
Rahmonberdi ota	8.5	12	3		26	30	230
Dadaboy	5	5.7	5		20	32.6	250
Tolibjon Dehqonov	4.1	10		0.3	25	35	
Kodirjon Nasredinov	2.4	10	0.5	1.2	25.2	52	100

Elmurod	5.3	10	2		25.2	52	200
Shams	3	10		2.5	17.6	31	
Mashrabov Tolibjon	7.7			2.3	20.1		
Ilesbek Ilhomjon	2	10			25.05	36	
Yunusali ota Begmatov	2	10			24.5	30	
Shodiboy ota	9.5				22.3		
Nurmatboy ota	3.8	10		0.7	22	35	
Munis ona	8.8	0			20.4		
Bahodir Tursunov	10.7	0	0	0	24	0	0
Lola	9.4	0	0	0	22.5		
Sheravazbek		8	0	0	0	36	0

Continuation

1. General information	24. Total cost, sum/ha		25. Profit, sum/ha		
	Farm	cotton	wheat	cotton	wheat
Alijon Ashurovlar Sahovati		0	433514	0	15211
Hamidullo Hikmatullo Kozokovlar		1034199	582452	-859199	20918
Abdullajon Toshmatov		633045	459902	162555	59880
Inom Ganiev		518885	391686	288955	194763
Fazilathon Bohodirjon zamini		848883	594751	-61723	163649
Ihtiyorjon Zohidjon ogli		835877	628787	-40277	3844
Eldorjon Rahimov		600879	486507	286521	154879
Munavar Yulduz zamini		549810	443501	-325810	257466
Madinabonu Matluba qizi		800093	463057	-4493	164216
Davranboy ogli Azizbek		541767	437743	223233	213857
Hakimjon ogli Rustam		616931	443716	148069	133207
Mamasidiq ota		522413	394714	273187	268286
Izzat Ibrohimov		562719	420737	232881	228490
Suhrobjon Subhonjon			495943	0	156557

Sharofathon Alisher	505650	395929	259350	240071
Anvar Siddiw zamini	555284	379753	240316	244247
Kahramon	523207	384373	241793	236627
Ahillikda baraka	529222	385222	266378	292778
Buyuk halifa	529729	392198	235271	266552
Tkuay Gavhari	547055	415076	217945	228678
Rustamjon ogli Hakimjon	535191	406925	260411	14679
Halifai davron	580867	375870	398340	322416
Irrigator Obidjon	549884	485084	399336	-5684
Kandiniso aya	578208	418761	163792	-79117

Continuation

1. General information	24. Total cost, sum/ha		25. Profit, sum/ha	
	Name of farm	cotton	wheat	cotton
Madrahimova Mavludahon	651592	430482	281707	35717
Istiqlol zamini	399573	335884	457227	84115
Botirbek	550716	331736	382584	187809
Baraka	535590	319137	278369	270468
Akmal	560790	463220	627210	147605
Bahtiyor Otajonov	615310	524389	210890	75610
Shahboz	636672	599048	158928	31952
Al-Masad	602845	508673	192754	5326
Ruzmatjon	613659	500177	181940	26528
Otahojaevlar	580540	551570	215060	-2570
Ibrohim	561883	447911	221477	73689
Donishmand	718319	416464	107881	66869
Muhiddinjon	693558	457522	285641	170478
Akbarjon	682028	481077	174772	32423

Ishonch	703608	537500	82811	-95072
Muazzam	689073	535198	137127	-79699
Aziza Muhtasarbonu	621238	505055	152941	37070
Baht	155917	492786	-155917	11094
Gulhumor qizlar	514514	372718	342286	157681
Mahamadjon-2	612644	393405	274755	190035
Shukurullo Ibrohim	575076	385287	342923	256496
Vositjon	646433	397160	271566	239323
Tolibjon Dehqonov	557048	394853	202952	163957
Kodirjon Nazredinov	527658	404458	238421	207541
Elmurod	672240	470806	93840	141194
Shams	505644	429956	29395	-24956
Mashrabov Tolibjon	604292		10768	0
Ilesbek Ilhomjon	649532	592906	116997	-56907
Shodiboy ota	531656	0	150723	0
Nurmatboy ota	508977	497800	164222	-103801
Munis ona	659309	312337	-35070	-312337
Bahodir Tursunov	492031	186568	237569	-186569
Lola	600657	302459	83342	-302460
Sheravazbek	526326	462326	233673	-34727