

# REGISTER OF RESEARCH ON IRRIGATION AND DRAINAGE

## QUESTIONNAIRE

<b>A</b>	<b>Project title:</b>	Saline drainage effluent use for irrigation on sandy-desert lands of South Kizilkum (Golodnaya Steppe).
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<b>B</b>	<b>Topic n° : 2</b>	Sub-topic n°: 2
<b>1</b>	1	Technical field n°: 3
<b>2</b>	Category 01	

<b>C</b>	<b>Project location: State farm N 7 and "Pravda"</b>	
	Country: Republik of Uzbekistan	Area: 27 ha
	<b>Precise details if possible</b>	
	Country(ies):	Locality
	City(ies):	(ies):
		Others(
		s):

<b>D</b>	<b>Duration of the project:</b>	
	Year in which the project was started 1974	Project completed: 1978 Expected completion date: 1979

<b>E</b>	<b>Organizations and technical staff involved</b>		
<b>1</b>	Supervisor/project coordinator (SURNAME, First name): Yakubov Khaldar Organization: SANIIRI Address: 11, Karasu - 4, Tashkent      telephone: E-mail:      fax:		100 %
	Other counterparts: First name	Organizations (full name or acronym)	Surname 2)
<b>1</b>			%
<b>2</b>			%
<b>3</b>			%
<b>4</b>			%
	Other collaborators: years		man-

<b>F</b>	<b>Funding agencies</b>
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Full name or acronym	Percentage of project finance provided
1 Ministry for Land Reclamation and Water management	30 %
2 Golodnostepstroy	70 %
3	%

**G Summary of research project (see instruction on page 1)**

**1 Objective and technical fields:**  
 Saline drainage effluent utilization for irrigation of cotton on sandy - desert lands.  
 Objectives: irrigation water optimal salinity selection; water salinity influence on cotton growth and yield.

**2 Scientific and technical approach:**  
 Definition of optimal salinity of drainage effluent for cotton irrigation to avoid soil secondary salinization and support sustainable yield. Development of recommendations for irrigation and leaching by saline water in Golodnaya Steppe

**3 Environment characteristics:**  
 Climate is sharply continental. Average air temperature is 12 - 13 °C. Duration of period without freezing - 180 - 200 days. Precipitation is 250 - 350 mm. Evaporativity is 1300 mm. Relative air humidity is 55 - 60 %, in summer it is 2 times lower.  
 Geomorphology: proluvial - alluvial valley of Syrdarya river. Surface slope is 0,005 - 0,0007.  
 Lithology: quaternary deposition: cover loam (2,5 - 3 m) with permeability coefficient 0,15 - 0,23 m/day which is underlain by sand (20 - 80 m) with permeability coefficient 20 - 25 m/day.  
 Groundwater level was 20 m before irrigation (1962). Since 1975 it was 2 - 25 m in summer and 3,5 - 4,5 m in winter. Salinity was 6,6 - 7,7 g/l and had chloride-sulfate type.  
 Deep groundwater artesian head is 0,1 - 0,3 m higher to compare with shallow groundwater level. Its salinity is 5 - 30 g/l. Type is sulfate-chloride.  
 Soils: Light and middle loam. Unsaturated zone rocks' permeability coefficient is 0,15 - 0,25 m/day. Soils of upper layer (to 0,8 m) are slightly salinized (0,3 - 0,4 %) and beneath salinity raises to 0,8 - 1,6 %. Soil are salinized to depth of 1,8 - 2,6 m.  
 Salinization type is chloride-sulfate. Undisturbed structure volumetric weight is 1,22 - 1,37 g/cu. m. Total area of lands subjected to salinization is 35 - 40 %.

**4 Parameters of Pilot Projects and Technical Solutions:**  
 Pilot site's area is 27 ha (2,5 ha net) and is divided into 12 fields with area 2160 sq. m. Main crop is cotton. Irrigation network concrete flumes. Efficiency is 0,96. Technical state is satisfactory. Drainage network - 3 horizontal drains with distance between them 168 and 200 m. Drain's depth 2,5 - 3,0 m, for collectors - 5,0 m.

**5 Methodology:**  
 Field investigation were carried out for definition of allowable salts concentration in drainage effluent without additional drainage network construction. Obligatory condition is soil fertility preservation and secondary salinization prevention.

Field investigation on cotton growing under saline water irrigation were performed within four versions.

- First version* (control) - irrigation by water with salinity to 1.0 g/l, chlorine - 0,1 g/l;
- Second version* - irrigation by mixture of irrigation and drainage water with salinity to 3 g/l, chlorine - 0,5 g/l;
- Third version* - by mixture with salinity to 5 g/l, chlorine - 0,8 - 1,0 g/l.

Fourth *version* - drainage water with salinity to 7, g/l, and chlorine -1,4 g/l.

Salt concentration was determined by periodical sampling and analysis.

Cotton sort was "Tashkent - 1".

Time and depth of irrigations were defined by level of moisture. Field moisture and calculated depth of wetting were determined.

Regular observation on soil salt - water regime, groundwater irrigation regime was executed. Pilot site was equipped by means of water accounting.

#### 6. Results:

Three watering were carried out within growing season: the first - 1003 (VI), second - 1375 (VII), third - 1630 cu. m/ha(VIII). Autumn - winter leaching was 2000 - 2500 cu. m/ha. Soil moisture before irrigations was supported as 0,7 - 0,8 FFMC. Before the first irrigation soil moisture within 1 m - layer was 1830 cu. m/ha, before the second one - 1482 cu. m/ha, before the third one - 1250 cu. m/ha. Field moisture of this thickness was 2732 cu. m/ha. Salt distribution along soil profile before irrigation and after growing period completion under irrigation by water with different salinity was as follow:

under irrigation by 1,0 g/l water salt balance was negative; salt stock within the unsaturated zone decreased to 49,6 t/ha;

under 3 g/l - balance was positive: salt accumulated to 21.9 t/ha;

under 5 g/l - to 67,9 t/ha and under 7 g/ha - to 234,7 t/ha.

Within the ploughed layer salt accumulation was low (0,2 - 0,4 %) but from depth 60 - 800 m sharply increased. This increase arable due to sulfate and chloride accumulation.

During July - October 1500 cu. m drainage water have been removed with salinity 9,7 - 15,7 g/l.

Water supply was 10090 cu. m with sum of salts - 45,2 t/ha.

It was found that under irrigation by 5 - 7 g/l water salinity intensive salt accumulation occurred due to salt introduction with water and saline water evaporation.

Cotton yield depended on irrigation water salinity under equal soil water - physical properties. Under plant density 47 th. plants/ha cotton yield was as follow according to versions:

Irrigation water salinity g/l	Average number of boxes on plant	Average weight of cotton boxes	Actual yield t/ha	Percentage from the control
1	2	3	4	5
1	17.0	4.5	30.9	100
3	16.3	4.6	28.7	93
5	15.0	4.5	27.5	89
7	14.0	4.2	24.0	75

According to the result the following conclusion may be drawn:

Allowable water salinity for cotton irrigation on new developed lands of Golodnaya Steppe should be determined for each separate site depending on soil salinity, its permeability, drainability, hydrogeological conditions:

- for the most parts of Golodnaya Steppe irrigation water allowed salinity should not exceed 3 - 4 g/l and  $CLSO_4$  content no higher than 0,2 - 0,6 %;

- irrigation norm should be not more than 4,5 - 5,0 th. cu. m/ha;

- under drainage effluent utilization for irrigation during 2 - 3 years it necessary to leach soil by rate of 2,0 - 2,5 th. cu. m/ ha which prevents secondary salinization;

- the first vegetation irrigation should be performed by fresh water and further by saline one;

- annual volume of drainage effluent, which could be used for irrigation within Golodnaya Steppe and Djizak scheme is 150 - 200 mln. cu. m.

Proposals for drainage water use were applied in 1979 when 145 mln. cu. m of water were used.

H	Suggested key-words		
1	Saline irrigation water	4	Irrigation norm
2	Irrigation system	5	Leaching rate
3	Soil salt regime	6	Water ion-salt composition

I	Most recent publications (maximum 3)			
1	Author(s): Z. Pushkaryova			
	Title: Saline water use for irrigation.			
	Publication details: Field investigations results on water of different salinity use for cotton irrigation within the Golodnaya Steppe. Changes of soil water - salt balance and drainage effluent salinity are shown.			
	Year of publication: 1978	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/>	confidential <input type="checkbox"/>
2	Author(s):			
	Title:			
	Publication details:			
	Year of publication:	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/>	confidential <input type="checkbox"/>
3	Author(s):			
	Title:			
	Publication details:			
	Year of publication:	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/>	confidential <input type="checkbox"/>