

**REGISTER OF RESEARCH ON IRRIGATION AND DRAINAGE**

**QUESTIONNAIRE**

<b>A</b>	<b>Project title:</b> Study of water-salt regime of strongly salinized gypsum-bearing soils of the South-East of Golodnaya steppe on background of perfect types of drainage.
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<b>B</b>	<b>Topic n° :2</b>	Sub-topic n°: 2
<b>1)</b>		Technical field n°: 2
<b>2)</b>	Category n°: 01	

<b>C</b>	<b>Project location:</b>		
	Country: Republic of Uzbekistan	Area: 110 ha	
	SyrDarya province, state farms 4, 5.		

<b>D</b>	<b>Duration of the project</b>		
	Year in which the project was started: 1972	Project completed: 1947	
		Dates of Expertise: 1975	

<b>E</b>	<b>Organizations and technical staff involved</b>			
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	Other counterparts:	Organizations	Surname	First name
<b>1</b>	A. Bukinga, Uzmelovodhoz			25%
<b>2</b>	G. Volkina, Uzmelivodhoz			25%
<b>3</b>				%
<b>4</b>				%
Other collaborators:		man-years		

<b>F</b>	<b>Funding agencies</b>	
	Full name or acronym	Percentage of project finance provided
<b>1</b>	Ministry for Land Reclamation and Water Management	100%
<b>2</b>		%
<b>3</b>		%

<b>G</b>	<b>Summary of research project</b>
<p><b>1 Objective and technical fields:</b>  Prevention of soil salinization and gypsum high content on background of perfect types of drainage, leaching and leaching regime of irrigation.  Objective: Development of water use and water-salt regime improvement on background of horizontal and vertical drainage for soil productivity increase.</p>	
<p><b>2 Scientific and technical approaches:</b>  Prevention of soils salinization and their productivity increase are based on perfect types of drainage application, leaching and leaching regime of irrigation providing optimal management by water and salt regime and designed crop yield achievement.  Importance: development of set of reclamation measures on soil with high content of gypsum productivity increase, water and land efficient use.</p>	
<p><b>3 Environment characteristics:</b>  Climate is characterized by tense hydrothermic regime and high wind intensity. Annual average air temperature is 14-15 °C. Frost-free period is 225-230 days . Sum of effective temperatures is 4000 °C. Precipitation is 300 mm/year with maximum in spring (45%) and in winter (35%). Evaporativity is 1500 mm from which 80% is attributed to spring-summer period. Humidity deficit is 1200 mm.  Geomorphology: alluvial plain which is made of quaternary sediments (thickness is &gt; 100m): alternating loam, sandy loam, clay and sand.  Hydrogeological conditions are complex because of small amount of underground outflow and surface runoff. Water level is close to land surface due to low permeability coefficient and surface slope. Groundwater salinity within upper horizon is high (5-10 g/l), at depth of 80m it is 1-3 g/l. Cover sediments permeability coefficient is 0,05-1,6 m/day; for pumped aquifer (20-90m) it is 2-2,5 m/day. Artesian head exceedance over groundwater level is 0,3-0,4m. Groundwater depth is minimum in May (1,5-2,0m) and maximum in December (3-3,5m). Waters are saline (15-40 g/l), type is chloride-sulphate.  Soils: light and middle loam. Before development they were strongly salinized (6-12 up to 28 mg.ekv on Na). Gypsum content was 10-20% and up to 30% of CaSO<sub>4</sub> * 2H<sub>2</sub>O. Before development (1957) 93-94% of area were strongly and very strongly salinized and only 6-7% were middle salinized. Relating to gypsum content 94-95% of area were middle and strongly and 5-6% were very strongly gypsum-bearing. During investigations 1m layer was mainly non-salinized or slightly salinized (70-74% of total area) and middle salinized (25-26%). Layer 1-2m was middle salinized (51% of total area); within 2-3 m layer middle and strongly salinity prevailed (85-90% of area). Cotton yield was on the average 1,28 - 1,3 t/ha. During 1961-1973 cotton yield was 0,7-1,25 t/ha.</p>	
<p><b>4 Projects and Technical Solutions:</b>  Water supply to the experimental plot is performed by on-farm canals. On site 5 there is tile drainage with drain depth 2,8m. On site 4 there are vertical drains with depth 77-94 m (screens are sandy-gravel strewed). Well discharge is 1,5-2,2 l/sec</p>	
<p><b>5 Methodology:</b>  Field observations over water-salt balance of aeration zone and groundwater, irrigation regime parameters. For this purpose experimental balance sites were established: farm 4-on background of vertical drainage (70 ha) and farm 5-on background of horizontal drainage (40 ha). Sites were equipped by water-meters and observation network for groundwater observations.</p>	
<p><b>6 Results:</b>  State farms were established in 1960. During the first years of development average water diversion was 9,0-11,0 th.cu.m/ha then it decreased down to 8,0 th.cu.m/ha. Newly</p>	

developed lands were used for cotton cultivation, cotton yield achieved on average 1,0-1,2 t/ha. Before development soils were half-hydromorphic-groundwater level was 2-3 m.

After systematic drainage construction groundwater level was more than 3 m. Leaching desalinated strongly saline soils. Leaching was performed by two methods: through crops-developers (rice) and "clean" leaching using water released from upper cheeks. High vertical drains discharges allowed to perform capital leaching without temporary drainage. Vertical drainage provided more regular soil desalinization over the area. Toxic salts stock within the layer 0-400 cm decreased from 78 to 55%. Vertical drain influence is 240 m; 354 t/ha salts were removed and 2m layer desalinization was achieved.

Soil desalinization under artesian water overflow is achieved to depth 1,0 m in spite of high leaching rates (25-35 th.cu.m/ha) and long duration. Experiments showed that leaching regime application after 0-20 cm layer desalinization provides designed high crop yield.

In state farm 5 under horizontal drainage two waterings in furrow by depth 1864-2810 cu.m/ha and irrigation norm 3874-5410 cu.m/ha were performed. Watering duration was 2-3 days.

Water expense for transpiration by crops and evaporation from soil surface is limited by active layer of water-stock (125-150 cm). Beneath this horizon water-stock does not change.

Maximum discharge occurs within the first days after irrigation: 120-140 mm (farm4) and 200-240mm (farm5). Under gypsum content within 0-1 layer 10-20% groundwater level 130 cm corresponds to limit field moisture capacity and level 205 cm to limit of dryness (75% of LFMC).

Because of soil stratification salt distribution within the profile is irregular. Maximum salt accumulation is attributed to soil of heavy mechanical composition. Anions  $SO_4$  prevail. Significant changes are noted for CL-ion in 0-100 cm layer, the same was observed for cation of Mg and Na.

Groundwater regime depends on water supply and drainage efficiency. Its level is 3,25-3,8m in spring near wells level is 2,25-2,75 m, between wells -1,5-1,6 m . Level depletion is slower for vertical drainage. During irrigation interval drainage outflow achieves 1581,1cu.m/day but to the end of growing season it decreases down to 691,2 cu.m/day. Drainage effluent salinity increases to the end of irrigation interval. At the end of September groundwater level is 2,65-3,35 m.

Groundwater salinity varied insignificantly (14,6-15,0 g/l) even under different irrigation norms. In autumn groundwater level decreased down to 3,5-4,0 and allows to create additional free volume for leaching.

During period of observations within both sites negative salt balance was created. Under horizontal drainage salt inflow was 4,06-6,0 t and outflow was 12,2-15,28 t.

Under vertical drainage salt removal was 8,87-9,93 up to 12,69t. Maximum salt removal was observed in July-August.

Particularities of plants development were found by phenological observations: development phases, cotton yield. Under horizontal drainage maximum gypsum content (55%) is attributed to depth of 50-100 cm. Within the upper horizons loose gypsum or provokes soil higher porosity but with the lower horizons it leads to soil compaction. That negatively influences plant yield. Maximum gypsum content (25-30%) is within 0-50 horizon. Cotton yield for both sites does not exceeds 1,55-1,67 t/ha. On experimental sites yield was 1,8-3,0 t/ha. Applied irrigation regime does not provide downward overflow and provokes seasonal soil salinization to the end of growing period. That is why reclamation measures should be accompanied by agrotechnical ones.

<b>H Suggested key-words</b>			
1	Soil water-salt regime	4	Groundwater level
2	Soil salinization	5	Evapotranspiration
3	Gypsum high content	6	Leaching regime of irrigation

<b>I Most recent publications (maximum 3)</b>			
1	Author(s): T. Trunova, I. Vasilyev, G. Khasankhanova		
	Title: Methodology for water requirement norms calculation in the AmuDarya and SyrDarya river basins.		
	Publication details: Methodology of water requirement norms calculation and groundwater lowering for design of water requirement for irrigation in AmuDarya and SyrDarys river basins are presented. This methodology is based on results of field investigations and unsaturated zone soil water-salt balance forecast.		
	Year of publication: 1984	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 type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>
3	Author(s):		
	Title:		
	Publication details:		
	Year of publication:	free access <input type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>