REGISTER OF RESEARCH ON IRRIGATION AND DRAINAGE

QUESTIONNAIRE

A	**Project title:**
	Sprinkler irrigation regime and technology efficiency vertification on salinizated lands of the state farm "Pakhtaaral"

B	**Topic n° :** 1	Sub-topic n°: 1
1)	02	Technical field n°: 1, 4

C	**Project location**		
	Chimkent province, Pakhtaaral district, state farm "Pakhtaaral"		
	Country: Republic of Kazakhstan	Area:	13000 ha
	Precise details if possible		
	Country(ies):	Locality(ies):	
	City(ies):	Others(s):	

D	**Duration of the project:**	
	Year in which the project was started 1955-1957	Project completed: 1992 Expected completion date: 1960, 1980, 1990

E	**Organizations and technical staff involved**				
1	Supervisor/project coordinator (SURNAME, First name): Yakubov Khaldar				70 %
	Organization: SANIIRI Address: 11,Karasu-4, Tashkent telephone: E-mail: fax:				Staff resources
Other counterparts:		Organizations (full name or acronym)	Surname	First name	2)
1	Djurayev Murat	SANIIRI			30 %
2					%
3					%
4					%
Other collaborators:			man-years		

F	**Funding agencies**	
	Full name or acronym	Percentage of project finance provided
1	State farm "Pakhtaaral"	60 %
2	SANIIRI	40 %
3		%

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

1 Objective and technical fields:

Sprinkler irrigation expendientness and efficiency on salinizated lands.

Objectives: Test of regime and technology of irrigation by sprinklers on salinizated lands.

2 Scientific and technical approach:

Development of sprinkler irrigation regime and technology on salinizated lands. Recommendations on prevention of soil salinization under sprinkler irrigation.

3 Environment characteristics:

Climate is characterized by high temperature differences. Average annual temperature is 12.5-13 ^{0}C. Period without frost duration is 170-200 days. Sum of positive temperatures is 4000-4100 ^{0}C. Precipitation is 250-350 mm, evaporativity is 1120-1280 mm. Relative air humidity is 55-60 %, in summer 25-30 %.

Geomorphology: SyrDarya alluvial plain, relief is slightly corrugated, slope is 0.0003-0.0005.

Lithology: Quaternary sediments; cover loam (15-25 mm, permeability coefficient is 0.1-0.15 m/day) is underlaid by small and fine-grained sand (25-100 m, permeability coefficient is 20-30 m/day). Before lands development groundwater level was 10-15 m, by 1958-1960 it raised to 1.0-1.5 m (spring) and to 2.5 m (autumn).

Groundwater salinity is 5-10 g/l. Artesian water head is 0.05-0.5 m higher than groundwater level. Underground inflow is 500-1000 cu.m/ha. Salinity is 4-5 g/l, sulphate-chloride. Artesian water is suitable for irrigation under condition of its mixing with fresh water by ratio of 1:2 and 1:3.

Soils: Sandy loam, light and middle loam with volume mass 1.29-1.34. Unsaturated zone soil permeability coefficient is 0.15-0.3 m/day. Soil is salinizated to depth of 2.0-2.5 m, salt content changed from 0.7 to 1.5 % on solid residue, type is chloride-sulphate. In 1958-1962 25-33 % of irrigated lands were middle and strongly salinizated. Total area of salinization was 75-80 % that led to cotton yield decrease to 2.4 t/ha. Along with furrow irrigation since 1955-1957 till 1990 sprinkler irrigation has been introduced by sprinkler-machines DDA-100 and DDA-100M.

4 Parameters of Pilot Projects and Technical Solutions:

Irrigated area is 13 th.ha (gross), 11.5 th.ha (net). Land use efficiency is 0.85. Crop is cotton. Water supply is executed from K-20 canal. Canals' extent is 200 km and they are mainly earthen. Head water intake is 11-13 cu.m/sec. Canal efficiency is 0.94; system efficiency is 0.7-0.75.

Collectors specific extent is 6-8 m/ha. There are 78 wells with depth of 55-75 m with gravel-sand screens. Drilling diameter is 426 mm, screen length is 15-30 m, well discharge is 50-75 l/sec, specific yield is 4-6 l/sec/m.

Sprinkler-machine parameters used for irrigation are shown in table below:

Parameters	DDA-100	DDA-100M
Tractor	DT-54	DT-75
Tractor capacity, HP	60	90
Pump	mechanical	mechanical
Discharge, l/sec	80	130
Head, mm mercury column	25	37
Rain intensity within flare, mm/min	2.4	3.8
Width of capture	110	120
Width of flare	14	17
Precipitation layer, mm	2-7	3-9
Drip diameter, mm	1.5	1.4
Time use efficiency	0.75	0.8
Weight without tractor, t	4.0	4.5

Sprinkler irrigation was performed by water-intake from temporary canals with distance between them 100-120 m and depth to 1.0 m.

5 Methodology:

Field observations and investigations of irrigation regime, water volume, soil moisture regime dynamics before and after irrigation. Multicriterial analysis was used as a tool for data processing.

6 Results:

Since state farm creation in 1955-1960 furrow irrigation was used. Since 1955 to prevent groundwater raise sprinkler irrigation was started by use of sprinkler-machine DDA-100 and DDA-100M. Water was supplied from temporary canals with depth 0.7-1.0 m and distance between them 100-120 m. By 1959 50-950 ha were covered by sprinklers, in 1978 this area was 6000-7800 ha.
Different irrigation depths were tested from 450 to 900 cu.m/ha with number of irrigations 2-6.
According to different schemes: 1-5-0; 1-4-0; 1-3-0; 1-2-0 with different moisture before irrigation (60-70-60; 70-70-60; 70-70-65; 70-70-70). Within 1956-1965 under shallow groundwater 3 waterings were performed by depth 450-600 cu.m/ha, irrigation norm was 1450-1800 cu.m/ha. Water supply to state farm practically did not change: 5.3-7.8 th.cu.m/ha (1950-1959) and 5.4-9.2 th.cu.m/ha (1960-1965) after sprinklers use.
Under sprinkler irrigation its norm during growing season decreased, but within non-growing period leaching rate increased.
Water losses are constituted by losses for evaporation during irrigation (7-8 %), direct water release during machine transition from one canal to another (15-40 %) and losses due to temporary canals' extent growth.
Within 1950-1965 soil salinization was under progress and cotton yield was decreasing (2.2-3.5 t/ha). Field experiments in state farm "Pakhtaaral" showed possibility of wide scale use of sprinklers on salinizated soils under drainability increase. Within 1960-1965 vertical drainage system (VDS) of 55 wells has been constructed and by 1970 - 78 wells, which provided groundwater level regulation (2.8-4.0 m) by leaching regime of irrigation. Since 1965-1966 during growing season 3 waterings were made by depth 700-900 cu.m/ha (irrigation norm is 2400-2700 cu.m/ha under groundwater level regulation within 2.8-3.0 m).
Within the autumn-winter period groundwater level was supported at depth 3.5-4.0 m that allowed to leach by rate of 3-3.5 th.cu.m/ha over farm as a whole, but for middle and strongly salinizated places to 8 th.cu.m/ha. Within 1965-1982 specific intake was 7-10.5 th.cu.m/ha (6.0-8.3 th.cu.m/ha net).
Taking into consideration rainfall, field water consumption was 8.7-11.3 th.cu.m/ha under evapotranspiration of 7.7-8.6 th.cu.m/ha (1.13-1.25). Infiltration was 0.8-2.7 th.cu.m/ha.
Irrigated land water-salt balance was negative with salt removal from unsaturated zone 20-30 t/ha and totally 14-21 t/ha. By 1970 by conjunctive use of sprinklers and leaching unsaturated zone soils were desalinizated.
Within 1965-1983 95 % irrigated lands were non-salinizated. Cotton yield was 3.5-4.3 t/ha. Sprinkler irrigation was used till 1990 though within 1984-1985 leaching regime of irrigation was destroyed. Sprinkler irrigation was ceased since 1992 due to high cost of maintenance.

H	**Suggested key-words**		
1	VDS	4	Watering depth and irrigation norm
2	Sprinkler irrigation	5	Leaching regime of irrigation
3	Soil water-salt regime	6	Groundwater desalinization rate

I	**Most recent publications (maximum 3)**			
1	*Author(s):* Kh.Yakubov			
	Title: Sprinkler irrigation experience in state farm "Pakhtaaral" on lands with tendency to salinization			
	Publication details: Analysis of 35 years experience of sprinkler irrigation use on saline soils, water-salt balance, soil water-salt regime, water and land productivity. Sprinkler irrigation high efficiency on background of vertical drainage is proved.			
	Year of publication: 1990	free access [x]	restricted [ ]	confidential [ ]