

REGISTER OF RESEARCH ON IRRIGATION AND DRAINAGE

QUESTIONNAIRE

A	Project title: Norms of Irrigation for Crops of Rice Crop Rotation on Soils with No or Slight Salinity on Irrigation Schemes in the Lower Syr Darya
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B	Topic n° : 1	Sub-topic n°: 2
1)	1	Technical field n°: 1
2)	Category n°: 01	

C	Project location		
	Country: Republic of Kazakhstan	Area: 8 ha (net)	
	Kzyl-Orda province; Syrdaryinsky, Terenozeksky, Karmakchinsky, Djalagashsky districts		

D	Duration of the project:		
	Year in which the project was started: 1964	Project completed: 1973	
		Dates of Expertise: 1968, 1973	

E	Organizations and technical staff involved			
1	Supervisor/project coordinator: Kvan Rem Alekseevich			%
	Organization: Kazakh Research Institute of Water Management (KazNIIVKH)			Staff resources 70
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	Other counterparts:	Organizations	Surname	First name
1	KazNIIVKH, Paramonov Alexander Ivanovich			30 %
2				%
3				%
4				%
	Other collaborators:		man-years	

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

G	Summary of research project
<p>1 Objective and technical fields: Planning and Implementation of water use with due regard for soil-reclamation and hydrogeological conditions and efficiency of an irrigation technique of an irrigated field. <i>Objectives:</i> Improvement of water use and increasing efficiency of irrigation schemes.</p>	
<p>2 Scientific and technical approaches: Determination of irrigation norms and increasing efficiency of irrigated lands on the basis of optimization of irrigation norms with due regard for soil-reclamation and hydrogeological conditions, and efficiency of an irrigation technique to achieve optimum water-salt regime of an irrigated field.</p>	
<p>3 Environment characteristics: Climate is sharp continental resulting in high annual and day amplitudes of air temperature and instability of climatic data in time. Duration of a warm period ($> 10^{\circ}\text{C}$) varies from 177 to 192 days. Sum of positive temperatures ($>10^{\circ}\text{C}$) varies from 3500 to 4100⁰. Precipitation is low, from 109 to 159 mm, in dry years precipitation can be only 50-70 mm per year, 10-30 mm in a warm period. Evaporativity is 1300-1600 mm. Moistening factor is 0,06-0,08. An irrigation scheme is situated in the valley of an ancient delta-flood plain and the first bottom of the Syr Darya. Relief is flat. Slopes are 0,0005-0,001. Regarding hydrogeological conditions, irrigated lands are situated in an area of difficult inflow and outflow of ground waters with depth of water table and regime depending on local conditions. Depth of water table on 40% of the irrigated area is lower than 3 m; on 42% - 2-3 m; on 18% - 1-2 m. Salinity of ground waters varies widely from 1-3 g/l to 3-5 g/l and more. Type of salinity is sulphate-chloride and chloride-sulphate. Irrigated lands in the Lower Syr Darya have mostly hydromorphic soils: alluvial meadow and meadow-bog soils; less often - desert, send and takyr soils. 65% of the irrigated area have middle-loam and light-loam soils, 20% have heavy-loam soils. There are 33% of soils with no and slight salinity, soils are saline on more than 50% of irrigated lands. Type of salinity is chloride-sulphate and sulphate-chloride. Length of the drainage network is 40-45 m/ha.</p>	
<p>4. Parameters of Pilot Projects and Technical Solutions: Kzyl-Orda left-bank irrigation scheme is situated on the left bank of the Syr Darya. It is a narrow strip 135 km long and 30-60 km wide which stretches from Kzyl-Orda hydrostation to Djusaly station. In 1980 the irrigation scheme included 13 rice-growing farms. Total area of the irrigated lands in this period was 85 th. ha. Water is abstracted by Kzyl-Orda dam which was put into operation in 1956. Water is delivered by left-bank main canal 140 km long, its capacity is 210 m³/sec.</p>	
<p>5 Methodology: Field tests on studying an irrigation regime for crops of rice crop rotation. On testing areas a series of observations and investigations was carried out on water-salt regime of soils; all elements of a water balance; growing, development and productivity of plants under different regimes of moistening and meteorological conditions. Testing areas were provided with lysimentering and water accounting equipment. Methodology of a problem solution was a systems analysis of the results of field observations and investigations using experimental data gathered in other irrigation schemes with the same environmental conditions.</p>	
<p>6 Results: Kzyl-Orda left-bank irrigation scheme is the most ancient rice-growing system in Kazakhstan. By middle 70s engineering rice systems had been created here, mostly of Krasnodar type, in some parts of the scheme - systems with rectangular checks with wide</p>	

flooding. Simultaneously with extending irrigated areas rice yield was increased up to 4,5-4,7 t/ha. Some farms produced up to 5,5-6,0 t/ha of rice grain. For improvement of water use regimes of irrigation for crops of rice crop rotation were elaborated differently taking into account soil-reclamation and hydrogeological particularities of the irrigation scheme. Irrigation regime for rice on lands with no and slight salinity (the area is 5 ha) was studied in 4 variants: 1. Constant flooding, without running water (control); 2. The same conditions as for the control plot but with running water of 20-30% of the total duty of water; 3. Interrupted flooding using 9 x 6 system (9 days of flooding, water layer is 10-15 cm; for 6 days water is not given to checks); 4. Shortened flooding (water is not given to checks during the milk stage of ripeness). Norm of irrigation for the control plot (on the average for the years of investigations) was 18430 m³/ha, rice yield was 4,56 t/ha, water expenditures per unit of production were 4040 m³/t. In the second variant the norm of irrigation was increased due to running water up to 23570 m³/ha and, correspondingly, water expenditures per unit of production were increased up to 5200 m³/tn, rice yield (45,3) was almost the same as in the control variant. Norm of irrigation on the plot with interrupted flooding was reduced down to 15170 m³/ha, yield was 1,02 t/ha less than on the control plot. The most rational variant is shortened flooding. Under this irrigation regime initial rice flooding after planting is maintained for 4-6 days with a water layer 10-15 cm deep. Then water supply stops, on sprouting a water layer 10-15 cm deep is maintained till the stage of bushing out, during this stage it is 5 cm, after this stage till the milk stage of ripeness it is 10-15 cm. During the milk stage of ripeness water supply stops, water stays in checks till its full absorption. Rice yield under the rational regime of irrigation on the average for the years of investigations was 4,56 t/ha. The norm of irrigation was 17430 m³/ha. Water balance of a rice field under the rational regime of irrigation: saturation of soil up to full moisture capacity is 3780 m³/ha (21,7%); water evaporation is 4620 (26,5%); transpiration is 2630 (15,1%); filtration is 6400 m³/ha (36,7%). Average water allowance of rice irrigation is 2,2-2,8 l/sec/ha; maximum water allowance (during the period of initial flooding and creation of a water layer on the surface of a rice field) for rectangular checks is up to 18,8 l/sec. per ha, for a rice field it is 4,8 l/sec. per ha. During next periods of flooding and maintenance of a water layer water allowance is reduced down to 1,0-0,8 l/sec. per ha. Keeping to the rational regime of irrigation of rice by available technique and technology of rice flooding inefficient water losses for surface release, filtration from canals, seepage from structures etc. are inescapable. Implemented investigations and measurements of waterings during the periods of flooding and maintaining a water layer in checks showed that losses in Kzyl-Orda left-bank irrigation scheme were on the average 33% of water supply. Gross norm of irrigation for soils with no and slight salinity is on the average 26000 m³/ha.

Irrigation Regime for Lucerne. The main second crop in rice crop rotation is lucerne. In tests on studying the irrigation regime for lucerne the following variants were tested: 1. Without irrigation (control); 2. Waterings with soil moisture of 60% normal moisture; 3. The same conditions with 70% normal moisture; 4. The same conditions with 80% normal moisture. On rice schemes ground waters take an active part in water supply of lucerne, their regime is connected with irrigation of rice on adjacent schemes. Lysimetering investigations which had been implemented on Akdalin irrigation scheme showed that ground water provide 44 to 95% of the total water consumption of lucerne. On the plot without irrigation yield of lucerne was 11,8 t/ha, water consumption factor was 493 m³/t, percentage of ground water participation in total water consumption was 87%. For maintaining the soil moisture of 60% normal moisture (variant 2) 1 watering with (gross) depth of irrigation equal to 1450 m³/ha was necessary, yield was 14,2 t/ha. In the third variant (70% normal moisture) two waterings with depth of irrigation equal to 1050 m³/ha each were necessary, gross depth was 2100 m³/ha. Yield was 4,1 t/ha higher than on the control plot. On soils with slight salinity high yield of lucerne with the least water expenditures per unit of production (478 m³/tn) was on plots with prewatering soil moisture in the layer of 0-100 cm of 80% normal moisture. In this variant 3 waterings were carried out with gross norm of irrigation equal to 2400 m³/ha. On

these plots for four hay-harvesting yield of lucerne was 14,9-15,0 t/ha for each.

H Suggested key-words			
1	Irrigation regime for rice, lucerne	4	Field water balance
2	Soil moisture	5	Soils with no and slight salinity
3	Depth of irrigation, norms of irrigation	6	Productivity

I Most recent publications (maximum 3)			
1	Author(s): Rem Kvan, Frants Vyshpolsky, Alexander Paramonov, Grigory Zhdanov, Sergey Magay, Robert Baranov		
	Title: Norms of Crop Irrigation in Kazakhstan (Recommendations). P.75		
	Publication details: Concrete values of evapotranspiration, norms of crop irrigation and watering depths for all the environmental zones of Kazakhstan are shown. Methods of taking into account soil-reclamation and hydrogeological conditions, methods and watering technique for calculation of gross norms of irrigation. Detailed example of planning crop irrigation scheduling is shown.		
	Year of publication: 1989	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:		
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