

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 (see instruction on page 1)	
1	<p>Field investigations on technology of vegetation and leaching irrigations under sprinklers EDM I "Kuban" on the background of systematic horizontal drainage.</p> <p>Objectives: To develop technology of soil desalinization on the background of drainage and irrigation of crops.</p>
2	<p>Scientific and technical approach:</p> <p>Objective and technical fields: Soil desalinization under sprinkler irrigation by "Kuban" unit does not require to take out lands from crop pattern and rotation, leaching duty decreases 2,0-2,5 times, leaching of area is uniform, upper fertile layer is not destroyed, nutrient elements are not washed out, hand labour is mechanized.</p>
3	<p>Environment characteristics:</p> <p>Climate is characterized by hot summer and relatively cold winter. Average annual air temperature is 8,9 °C; average monthly temperature for July is 23.1 °C, for January is - 73,1 °C. Average relative air humidity is 60-70 %. Sum of positive temperatures exceeding 10 °C is 3300 °C.</p> <p>Pilot plot is located within the alluvial-proluvial plain with slight slope to the north. Altitudes are 630-650 m. Location is groundwater seepage place with slight natural drainage. Groundwater level is 2,5-3,3 m. Its salinity varies from 1,8 to 8,9 g/l. Chemical composition is hydrocarbaceous-sulfate. Soils are hydromorphous, meadow and grey -meadow. Mechanical composition of soil indicates on middle and heavy loam.</p> <p>Soil salinization type is sulfate with high content of gypsum, in some places with soda. Total alkalinity is 0,03 % and seldom it achieves 0,1 %. Before investigations soil salinity was as follow (%): non-salinized - 1,7; slightly salinized - 25,7; middle salinized - 50,3; strongly and very strongly salinized - 22,3.</p>
4	<p>Parameters of Pilot Projects and Technical Solutions:</p> <p>Pilot plot's size is 4000x3120 m and it is located within 10 fields of 3-rd rotation of state farm "Kalechek". Each field area is 120-126 ha. Systematic horizontal drainage is represented by: primary drains with distance between them 400-420 m, depth 3,5-4,6 and slope is 0.0024-0.0048, length is 800-2000 m., ceramic tubes diameter 150-350 mm on gravel-sandy screen; tertiary collectors are ceramic and concrete tubes with diameter respectively 200-300 and 400-800 mm, length 1800-1860 m, depth 3,5-5,5 m, slope 0,0019-0,0022 and secondary collectors: depth 4,6-5,0 m in the ground bed.</p> <p>Irrigation canals are lined by concrete, open water supplying network to each "Kuban" unit has length 800 m. 15 canal's sites are distinguished with regulated gates. They have no slope, their depth is 0,65-0,85 m to create water stock of 1600 m³ to provide one machine operation within 2,5</p>

hours.

Crop pattern: corn for grain, corn for silage and beans. Irrigation norm was varying depending on crops within the broad range: alfalfa for hay 15-17 irrigations by depth 7300-8300 m³/ha alfalfa for seeds 3-4 irrigations by depth 1017-2000 m³, and sugar beet for seeds 5-6 irrigations by depth 2300-3110 m³/ha. Drainage outflow through horizontal drains was 210-2340 m³/ha.

5 Methodology:

Field investigations included the following observations: soil sampling for full chemical analysis and moisture, nutrient substances and water-physical properties; irrigation, drainage and groundwater sampling for full chemical analysis, definition of irrigation depths, drainage outflow, groundwater level between drains, crop state and yield observation.

Soil moisture dynamics was observed in 4 points within 1,2,9,10 fields (in the middle of each place between rows) within the soil horizons: 0-30, 30-70, 70-100 cm before and after each irrigation during all growing period.

Soil salinization dynamics observations were carried out through the special wells distanced one from another for 1, 3, 5, 10, 20, 50, 100 and 200 m from drain axis, during growing period each 5-7 days.

Drainage outflow was observed each 5 days through the weirs positioned at the end of site or by volumetric method.

Water supply for irrigation was accounted by the weirs which were positioned in the irrigation canals heard: crop yield was determined in 12 points according to the commonly accepted methodology.

Soil sampling was carried out by Nekrasov's drilling rig: soil moisture by thermostat - weight method; salt content in soil and water by laboratory methods.

6. Results:

Investigation showed the following : Salt survey in 1989 showed that in the lands of 3-rd rotation substantial changes occurred: non-salinized and slightly -salinized lands areas increased to 40,3 and 30,1 %; areas of middle, strong and very strong salinized lands decreased to 17, 8, 10,5 1,3 %.

Soil salinization dynamics all over the soil profile to depth of 3 m and statistical evaluation of reliability of these changes under influence of sprinkler irrigation and drainage show that substantial changes occurred within the horizons 0-30 and 0-100 m all over the 10 fields of 3-rd rotation; for non-salinized lands (15-th field) within the 3 m profile further salt content decrease is noticed under groundwater salinity 3-6 g/l; for middle-salinized lands (10-th fields) within the 0,6 m horizon desalinisation occurred within the layer 0-30 cm, in the rest of the horizons it remained the same.

Soil moisture regime was kept before irrigation at 0.6-0.8 of full field moisture capacity (FFMC) and after irrigation - 0,8 - 1.1 FFMC, interval between irrigation were 1 - 4 days, irrigation depth varied from 100 to 730 m³/ha and under 11 irrigations it was 5450 m³/ha; filtration through 1 m - layer was 1160 m³/ha.

Drainage outflow was 1708 m³/ha; Sugar beet biological yield was 37.2 t/ha. Under water deficit within the 2-nd field its yield was 25,9 t/ha.

Developed technology of soil desalinization on the background of drainage and irrigation of crops-developers (alfalfa and sugar beet) by sprinkler machine "Kyban" takes into account the following indices:

Soil salinization map; salt-tolerant crop pattern within the most salinized fields; leaching irrigations (if required) to carry out at the beginning and the end of growing period taking in consideration that water supply within this period does not require to increase passage of heard water structure and main irrigation canal.

During 7 years of pilot plot maintenance on the background of sprinkler irrigation and systematic drainage soil reclamation state has been improved (groundwater level, soil 1 m - layer salinization, ground and drainage water salinity).

The best crop developer is alfalfa for hay and silage which shades soil surface properly and protects it from evaporation, providing its optimal moisture of 0,8-1,0 FFMC.

Soda-salinated soil's reclamation is executed by gipsum additives and fertilization by superphosphate, ammonium sulfate, etc. without leaching after gipsum addition with deep ploughing.

Annual economic effect was 245 rouble/ha

H Suggested key-words			
1	Systematic horizontal drainage	4	Water-soil and nutrient regime.
2	Sprinkler irrigation.	5	Reclamation state-dynamics.
3	Water-salt and nutrient soil balance	6	Crops-developers.

I Most recent publications (maximum 3)			
1	Author(s): S.Popova		
	Title: Soil water and salt regime under sugar beet irrigation		
	Publication details: Paper shows water and salt balance under sprinkler irrigation within the 1-st and 2-nd fields of 3-rd rotation: sugar beet yield and irrigation rate relations are established.		
	Year of publication: 1985	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>
2	Author(s): S.Popova, V.Miroshnikov, E.Shesler		
	Title: Soil desalinization on background of drainage and crops-developers irrigation.		
	Publication details: Paper gives technology of salinized and sodified soils on the background of drainage and crops-developers by "Kuban" machine. Calculation formula is proposed for leaching duty definition.		
	Year of publication: 1987	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>
3	Author(s): L.Gossu, I.Duynov, V.Miroshnikov		
	Title: Ecological aspects of the Chu valley salinized lands desalinisation under sprinkler irrigation.		
	Publication details: Advantages of the Chu valley salinized lands sprinkler irrigation without capital leaching.		
	Year of publication: 1995	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>