

1.1 Natural and economic characteristics of pilot plots

1.1.1 Climatic characteristics

All the pilot plots for water consumption rates and irrigation regime studies are located within the area of sharp continental climate (fig.1.1 - PP location map), where average monthly temperature varies within 10 -13°C (state farm “G.Goulyam”, collective farm “Khalkabad” - Uzbekistan) and 15-16°C (state farm N24 in Uzbekistan, K. Marx collective farm, Lenin collective farm and Scientific Production Association (SPA) “Zemledelie” in Tadjikistan). Maximum temperature is 44-47°C in July and early August and minimum one is –10-(–24)°C. Total effective temperature ranges from 2500°C (NISTO, K.Marx collective farm and SPA “Zemledelie” - Hissar region) up to 4000-4500°C (Appendix 2). High precipitation (600-650 mm) occurs, on the contrary, in plots located in upper terraces of the Vaksh river (K.Marx collective farm and SPA “Zemledelie” - Hissar region) and small precipitation (70-80mm) occurs, for example, in collective farm “Khalkabad” in Khorezm province. Evaporativity for all the plots is 1100-1200 mm, while maximum one is 1500-1515 mm in Hissar district. Evaporativity in Khalkabad, Khorezm province, is 1000-1200 mm. Evaporativity and precipitation cause water deficit, which varies annually from 1120 mm (Khalkabad, Khorezm province) up to 1480 mm (state farm N24 and G.Goulyam state farm, Syrdarya province). Water deficit in plots located in the Vaksh valley, Karshi is 765-873 mm due to comparatively high precipitation (appendix 2). The lowest coefficient of moistening is 0,068 in Amudarya deltas and upper terraces of the Syrdarya river and 0,032 in Khalkabad and Lenin collective farm, while the highest one is 0,42-0,44 in the Vaksh valley. Frost-free period in cotton irrigation regime plots is 170-240 days.

1.1.2 Geomorphological and hydrogeological characteristics

The plots have the following geomorphological structure:

- NISTO plot is located in corrugated plane of the Chirchik river with thick layer of fine grained soils and more than 0,002-0,03 slope gradient. Permeability varies within 0,5-1,0 m/day in top loamy layer; groundwater level is 5-10 m below surface.
- There are proluvial and alluvial sediments of sloping plane in SPA SANIIRI’s G.Goulyam state farm and state farm N24 located in Karshi steppe. Lithology: thick layer of fine grained soils, permeability of aeration zone layer is 0,3-0,5 m/day (G.Goulyam state farm); multilayer soil, stratified with loam, sandy loam, sands and pebbles, permeability of top layer is 0,8-1,0 m/day. Groundwater level before irrigation was 3-5 m below surface and varied within 1,5-3,0 m after irrigation. Groundwater salinity is 5-15 g/l for the most part of area; type of salinity is chloride-sulphate (Appendix 3).
- Khalkabad plot in Khorezm province is located within Amudarya river delta. There are alluvial sediments, including fine grained soils, sandy loam, loam with 3-5 m thickness and sands below. Permeability is 0,3 m/day for top layer, while it is 10-12 m/day for sands. Groundwater level is 0,5-1,5 m. Waters are slightly salinized - up to 3-4 g/l. Type of salinity is sulphate and chloride-sulphate.

There is no considerable outside ground inflow to all the plots. However, during irrigation systems operation local head could be formed through seepage from canals and infiltration from irrigated fields.

- Geomorphology of the pilot plots from Tadjikistan comprises alluvial-proluvial sediments of the Syrdarya river (collective farm Leninizm, Khodjekent district) and the Vaksh river (K.Marx collective farm and SPA “Zemledelie”). Lithology includes multilayer sediments; slope is 0,012-0,02. Groundwater level is 4-5 m below. Permeability of top layer ranges from 0,5-0,6 m/day to 3,6 m/day (Lenin collective farm).

1.1.3 Soil-reclamation characteristics of the pilot plots

Soils of all seven pilot plots for cotton water consumption and irrigation regime studies belong to gray type. NISTO plot has typical gray soils and deep groundwater. Soil texture is medium loam; volumetric mass is 1,18-1,45 g/m³. Soils are non-salinized. The plot belongs to zone III according to water allowance zoning.

State farms of G.Goulyam and N24 (Karshi) have strongly alkaline and alkaline gray soils as well as meadow-gray soils. The soils comprise silt loam and sandy loam; volumetric mass is 1,33-1,42 g/m³, specific mass is 2,4 g/m³ (Appendix 4).

Collective farm Khalkabad in Khorezm province have marshy and marshy-meadow soils, which were formed under hydromorphous regime. Groundwater level is 0,5-1,5 m. Soil texture is loam with clay interlayers. Volumetric mass is 1,44-1,47 g/m³; specific mass is 2,6-2,65 g/m³. Soils of all the plots, excluding NISTO, within Uzbekistan are salinized.

Salt content in top soils of G.Goulyam state farm and collective farm Khalkabad ranges from 0,7-1,8% to 3,0% by solid residue and from 0,02-0,03% to 0,7% by chlorine ions. By salt distribution soils of G.Goulyam state farm are salinized deeply, while collective farm Khalkabad has superficial salinization, which is formed by shallow waters. Type of salinity is chloride-sulphate.

State farm N24 has strongly alkaline and alkaline soils, which are formed by deep ground water. However, during development salt profile is transformed, i.e. strongly alkaline soils are transformed to superficial salinization, which is connected with groundwater level raise.

All 3 plots for cotton water consumption studies in the Republic of Tadjikistan have light and typical gray soils formed under automorphous regime. Soil texture - loam; volumetric mass - 1,3-1,48 g/m³; specific mass - 2,6-2,7 g/m³. All the soils are non-salinized with highest moisture capacity varied within 23-26% of full field capacity (FFC), while in other plots moisture capacity varies within 18-22% of FFC (Appendix 4).

1.1.4 Parameters of the pilot plots with cotton water consumption rates and irrigation regime

All the pilot plots for cotton water consumption rates and irrigation regime studies are referred to experimental-production plots according to IPTRID register and have minimum cropped and experimental area ranging from 2-18 ha to 100 ha and maximum one from 100 ha to 400 ha. Land use efficiency is 0,83-0,93, except G.Goulyam state farm, where it does

not exceed 0,72. Irrigation network in G.Goulyam and N 24 state farms is provided with flumes, while in other plots it lays in earthen channels. Due to this fact efficiency of on-farm irrigation network in NISTO, G.Goulyam and N 24 state farms is 0,9-0,92, while in other plots it is 0,8-0,9. Lowest efficiency (0,6) is in Khalkabad, Khorezm province. All plots use furrow irrigation for cotton, except NISTO by SPA SANIIRI, where sprinkler irrigation is used as well. Water was supplied through long furrows ($L_f = 250-350m$) in G.Goulyam and N 24 state farms and through short furrows ($L_f = 100-150m$) in other plots. Furrow capacity was determined according to soil texture, permeability and slope. All the pilot plots located on salinized lands are provided with artificial drainage (its parameters are given in table I.1.1).

Table 1.1.1

Parameters of the pilot projects and agricultural-technical decisions in «irrigation regime and water consumption norm» direction

Code	Location	Farm speciality	Area, ha	ϖ plot, ha	Irrigation technique	Irrigation network parameters		Drainage network parameters		
			Land use efficiency			Specific length, m/ha	Efficiency	Discharge, l/s	Specific length, m/ha	Depth, m
1.01.Uz	NISTO (Tashkent province)		$\frac{90}{0,87}$	18	furrow and sprinklers	30-35	09	-	-	-
1.02. Uz	collective farm G.Gulyam (SyrDarya province)	cotton	$\frac{1500}{0,72}$	10	furrow	25-30	0.92	0.1	60-70	2.6-3.0
1.03. Uz	«October», Karakalpakstan	rice and livestock	$\frac{45}{0,75 - 0,83}$	45	cheks	35-40	0.85	0.7-1.0	40-45	1.8-2.5
1.04. Uz	«Tinchlik», Yangi-yul dist., Tashkent province)	cotton-grain	$\frac{1968}{0,75}$	0,5	flood	28-30	0.68-0.73	-	-	-
1.05. Uz	Farm Yangiabad (SyrDarya province)	rice	$\frac{130}{0,80}$	130	cheks	30	0.5	0.12-0.2	30-40	до 1.5
1.06. Uz	collective farm Khalkabad (Khorezm province)	cotton	$\frac{400}{0,83}$	400	furrow, L=150 m	30-75	0.11	006-0.1	40	2.7-3.0
1.07. Uz	collective farm Niyazov (Fergana province)	cotton-grain	$\frac{160}{0,9}$	160	furrow	25-30	0.95	0.3-0.4	40-50	2.7-3.0

Code	Location	Farm speciality	Area, ha	̑ plot, ha	Irrigation technique	Irrigation network parameters		Drainage network parameters		
			Land use efficiency			Specific length, m/ha	Efficiency	Discharge, l/s	Specific length, m/ha	Depth, m
1.08.Y	collective farm #24 (Karshi Steppe)	cotton	$\frac{100}{0,94}$	100	furrow, L=300-400 m	-	-	-	-	>3.0
TADJIKISTAN										
1.01.Tad.	collective farm «Kommunizm» (Kumsagir district)	cotton	4	4	furrow, L=130 m	-	-	naturally drained territory		
1.02. Tad.	collective farm «Turkmenistan» (Bokhtar district)	livestock (maize)	2/0,9-0,93	2	furrow, L=120-130 m	55	0.85	naturally drained territory		
1.03. Tad.	SPA «Zemledelie» (Gisar land)	grain	$\frac{2}{0,92}$	2	furrow, L=100 m	45-50	0.85	naturally drained territory		
1.04. Tad.	collective farm Lenin (Khodzhent district)	cotton	$\frac{10}{0,93}$	10	furrow, L=100-150 m	50-55	0.72-0.85	naturally drained territory		
1.05. Tad.	collective farm Karl Marx (Gisar district)	grain	$\frac{2}{0,9}$	2	furrow, L=100 m	55	0.85-0.9	naturally drained territory		
1.06. Tad.	farm of Institute of agriculture (Gisar district)	cotton	$\frac{2}{0,9}$	2	furrow, L=100-120 m	50-60	0.88-0.92	naturally drained territory		
1.07. Tad.	collective farm «Khosilot» (Lenin district)	овоще-бахчеводское	$\frac{1,5}{0,91}$	1,5	furrow, L=100 m	60	0.85-0.9	naturally drained territory		
KYRGYZSTAN										

Code	Location	Farm speciality	Area, ha	ϖ plot, ha	Irrigation technique	Irrigation network parameters		Drainage network parameters		
			Land use efficiency			Specific length, m/ha	Efficiency	Discharge, l/s	Specific length, m/ha	Depth, m
1.01.Kyrg	collective farm «Prigorodny» (Alametdin district)	vegetable-livestock	<u>1643</u> —	1643	sprinklers on surface	-	0.6	0.1-0.12	44.4	2.5-2.7
TURKMENISTAN										
1.01.Turk	collective farm «Vatan» (Akhal district)	vegetable-cotton	lizimetric	50 m ² x 10 (10 sites)	-	-	-	-	-	-