4.2 Pilot studies of optimal irrigation methods, parameters of irrigation technique and technology

4.2.1 Irrigation methods used in PP

Selection of irrigation methods and relevant elements of irrigation technique is based on combinations of soil permeability and slopes of irrigated area. Table 4.4 shows distribution of irrigation methods used in PP by combinations “permeability-slope”.

Most plots (51% of total number) are under furrow irrigation. They are followed by plots with drip irrigation (33%), sprinkling (8%) and subsoil irrigation (8%). Irrigation water productivity increase was studied under cotton cultivation (74% of total plots). Other crops cultivated were, mainly, vines and orchards.

Table 4.4

Distribution of the pilot plots by irrigation methods

Permeability	Slopes						**Total**
	I’	I	II	III	IV	V	
A	**1**	**4(2)***			**1(1)**		**6(1)**
including:							
Furrow irrigation		2(1)			1(1)		**3(2)**
Drip irrigation	1	2(1)					**3(1)**
Subsoil irrigation							
Sprinkling							
B	**2**	**2(1)**	**3(3)**	**3(3)**	**3(3)**	**1(1)**	**14(11)**
including:							
Furrow irrigation		2(1)	2(2)	1(1)	1(1)		**6(5)**
Drip irrigation	2		1(1)	1(1)	2(2)		**6(4)**
Subsoil irrigation							
Sprinkling				1(1)		1(1)	**2(2)**
C	**2**			**2(2)**	**3(3)**	**2(2)**	**9(7)**
including:							
Furrow irrigation						2(2)	**2(2)**
Drip irrigation	2			1(1)			**3(1)**
Subsoil irrigation					3(3)		**3(3)**
Sprinkling				1(1)			**1(1)**
D			**1(1)**	**2(1)**	**1(1)**	**4(3)**	**8(4)**
including:							
Furrow irrigation			1(1)	1	1(1)	4(3)	**7(3)**
Drip irrigation				1(1)			**1(1)**
Subsoil irrigation							
Sprinkling							
E			**1(1)**			**1(1)**	**2(2)**
including:							
Furrow irrigation			1(1)			1(1)	**2(2)**
Drip irrigation							
Subsoil irrigation							
Sprinkling							
Total	**5**	**6(3)**	**5(5)**	**7(6)**	**8(8)**	**8(7)**	**39(29)**
including:							

Permeability	Slopes						**Total**
	I'	I	II	III	IV	V	
Furrow irrigation		**4(2)**	**4(4)**	**2(1)**	**3(3)**	**7(6)**	**20(16)**
Drip irrigation	**5**	**2(1)**	**1(1)**	**3(3)**	**2(2)**		**13(7)**
Subsoil irrigation					**3(3)**		**3(3)**
Sprinkling				**2(2)**		**1(1)**	**3(3)**

* In brackets - number of PP with cotton irrigation

4.2.2 Furrow irrigation of cotton

Increase of irrigation water productivity at a level of irrigated field was achieved through use of optimal for specific conditions combinations of irrigation technique elements (flow in furrow (fig.4.10), furrow length (fig.4.11), watering duration (fig.4.12), depth of irrigation (fig.4.13)), that provided decrease of deep infiltration outside rooting zone and surface release (Appendix 4.4), as well as through improvement of furrow irrigation.

Those methods, described in the registers, can be differentiated in tabular form (table 4.5), depending on zone, in which PP is located, and crop irrigation problems.

In the zone of very high slope gradients (from 0.025 to 0.05) increase of field efficiency was achieved through the following:

- staged, differentiated water supply from irrigation modules with flexible conveying and watering hoses to zigzag micro-furrows;
- colmation irrigation regime of thin fine-grained soils on pebbles foundation under subsurface irrigation network (SIN) with flexible watering hoses as well as through polymeric soil conditioners to fasten furrow bed;
- special regime of irrigation stabilizing subsidence processes.

In zone of high slope gradients (from 0.0075 to 0.025):

- linking of irrigation with the whole cycle of agrotechnical works and focusing of ditch irrigation flow in one irrigated field;

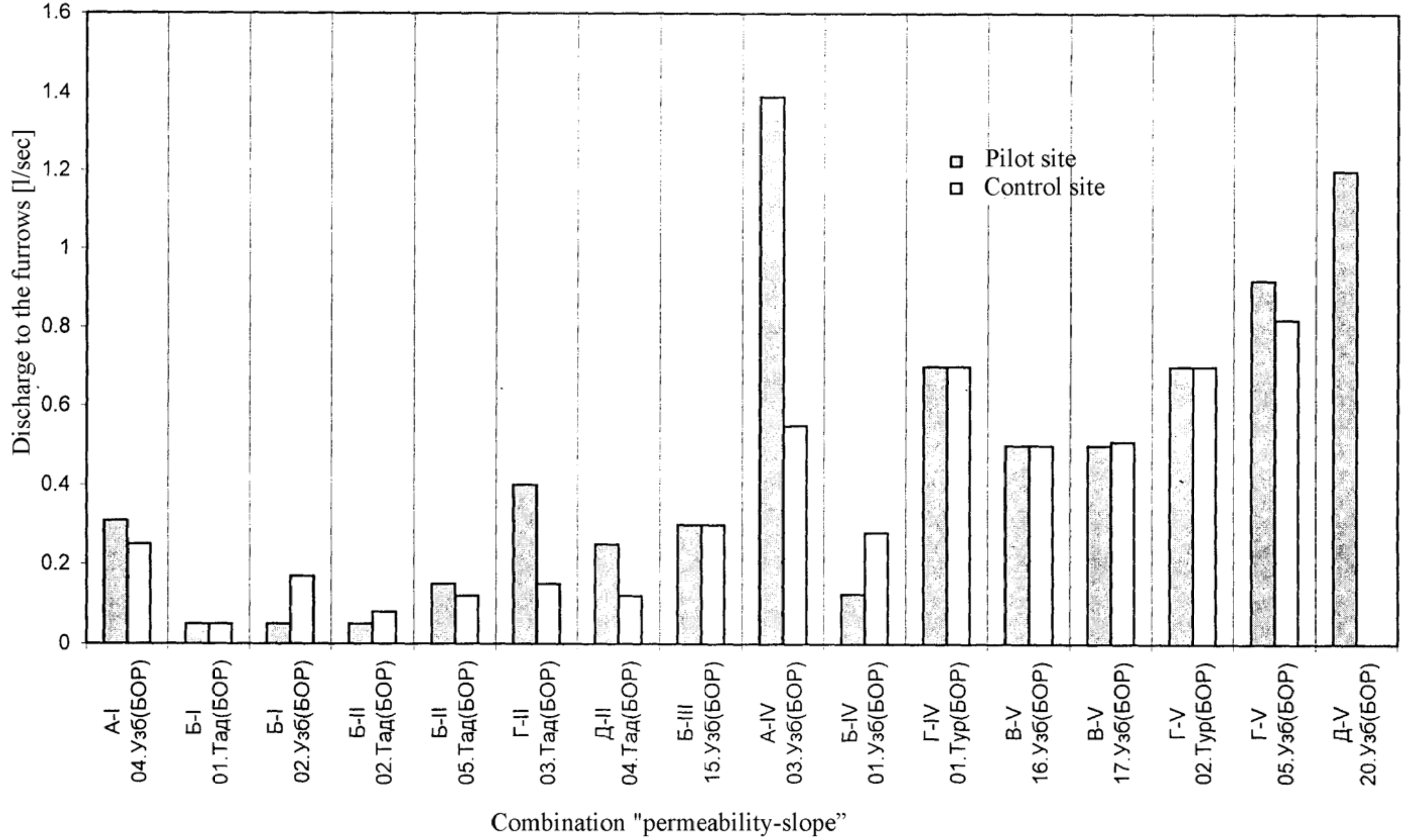

Fig. 4.10. Discharge to the furrows depending on combination "permeability-slope"

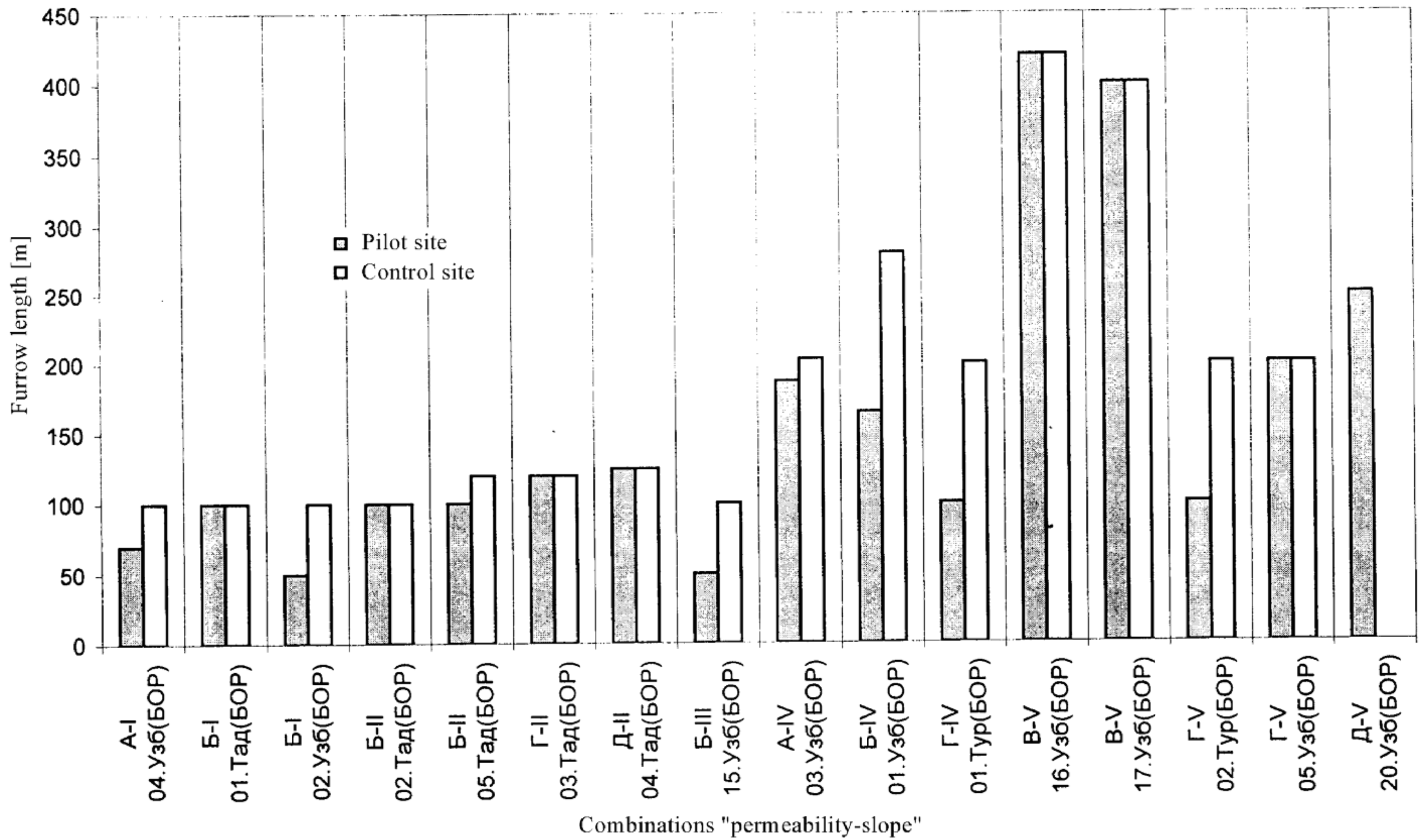

Fig. 4.11. Furrow length dependance on combination "permeability-slope" under cotton irrigation

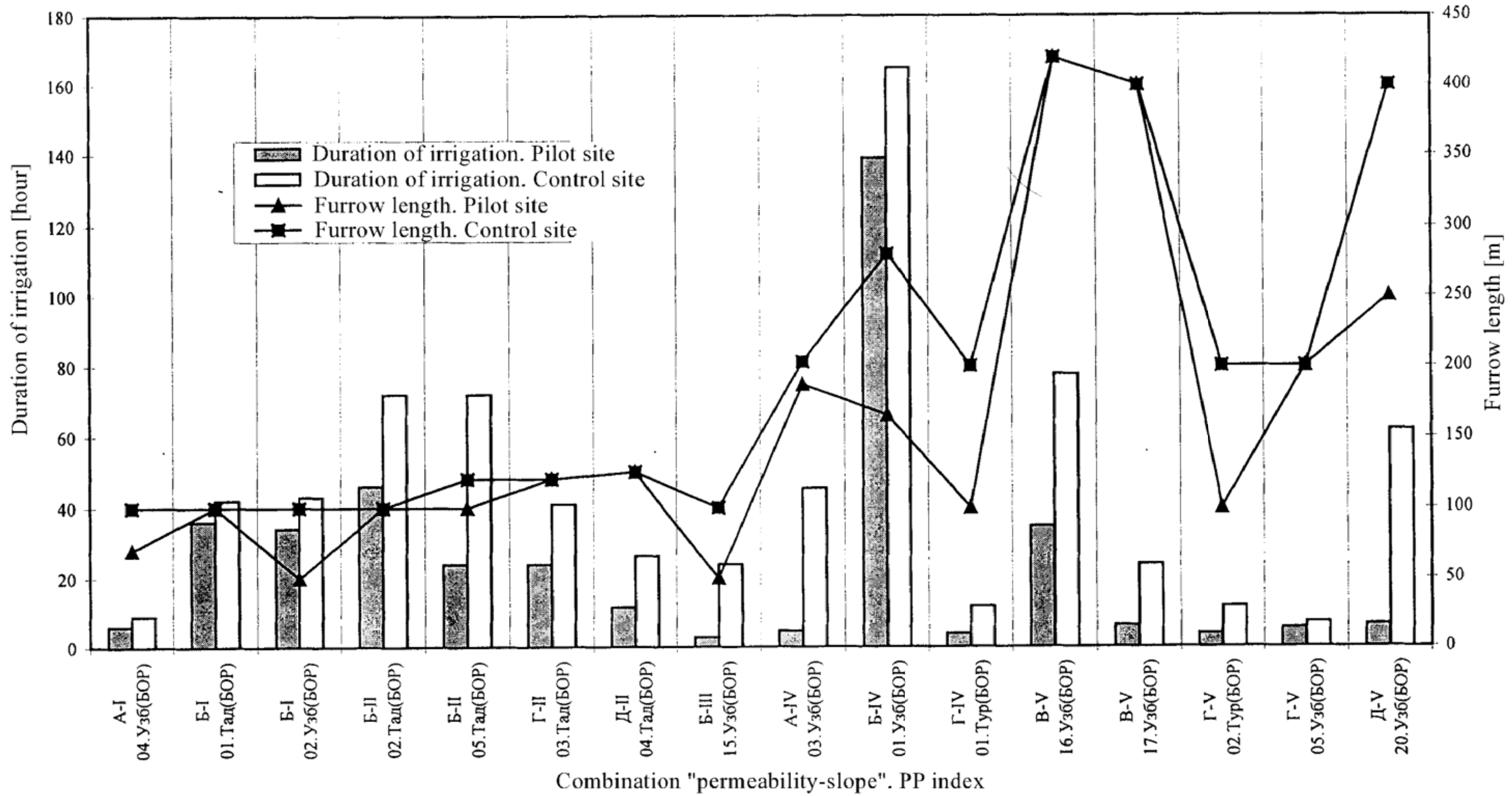

Fig. 4.12. Comparative duration of cotton irrigation by various length furrows. Comparision of pilot site with control one.

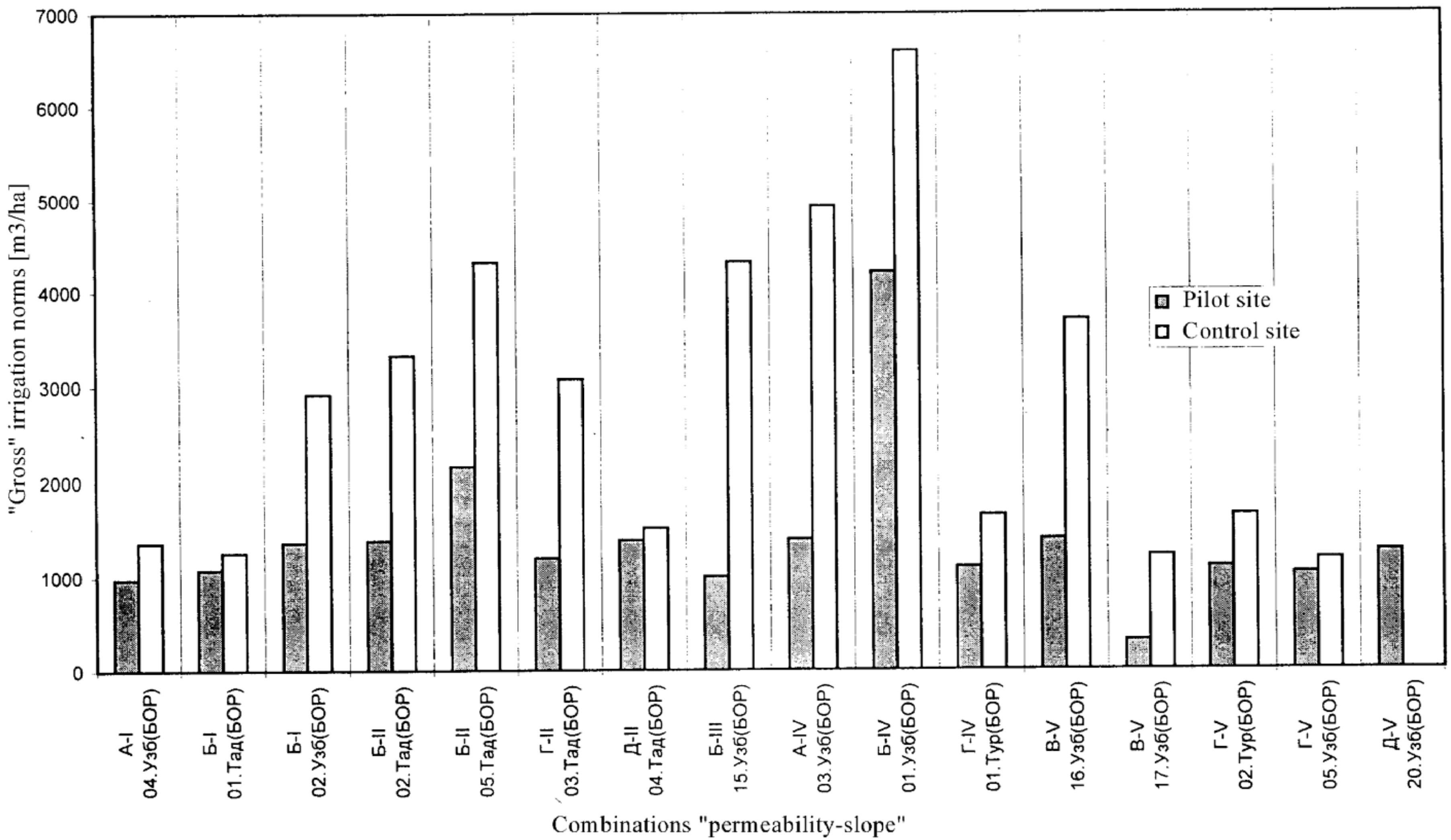

Fig. 4.13. "Gross" irrigation norms dependance on combination "permeability-slope" under furrow irrigation of cotton

Table 4.5

Relative characteristics of cotton furrow irrigation

Plot index	Soil-climatic zone	«Slope - permeability» index	Water allowance rayon	Soil salinity degree	Data type	$L_б$ [m]	a [m]	$q_б$ [l/s]	$t_{доб}$ [hour]	$T_{пол}$ [hour]	$m_{бр}$ [m³/ha]	Irrigation water technological expenses: evaporation [%]	infiltration [%]	release [%]	$m_{нт}$ [m³/ha]	Efficiency	Number of vegetation irrigation	Irrigation interval [day]	Area of simultaneous irrigation [hà]	Main methods of irrigation perfection and irrigation water use efficiency increase
Gradients from 0.025 to 0.05																				
04.Uz. (БОР)	Ц-II-Б	А-I	I	non saline	О	70	0.6	0.31	1	6	974		7.5	10	800	0.82	7	10-15		Colmatation regime of low thikness fine-grained deposits irrigation on gravel basement; polymeric structure forming elements application for strengthening furrows. Close irrigation network with flexible hoses.
					К	100	0.6	0.25	2	9	1366	1	20	28	697	0.51	7			
01.Tad (БОР)	Ю-I-Г	Б-I	II	non saline	О	100	0.6	0.05		36	1080	3	15	12	756	0.7	6			Differenciated water supply from irrigation modules with flexible hoses and zigzag-shaped microfurrows
					К	100	0.6	0.05		42	1260	3	16	19	781	0.62	6			
02.Uz. (БОР)	Ю-I-Г	Б-I	II	non saline	О	50	0.9	0.05		34.2	1371	5	3	7	1165	0.85	5		6-8	Special irrigation regime stabilizing subsidence processes
					К	100	0.9	0.17		43	2915	2	42	15	1195	0.41	6			
Gradients from.0075 to 0.025																				
02.Tad. (БОР)	Ю-I-Б	Б-II	II	non saline	О	100	0.6	0.05		46	1393	5	4	15	1059	0.76	7	10-15	7-12	Irrigation connection with agrotechnic cycle, concentration of irrigation flow on one irrigated field
					К	100	0.6	0.08		72	3329	6	18	40	1198	0.36	4			
05.Tad. (БОР)	Ю-I-Б	Б-II	II	non saline	О	100	0.6	0.15		24	2160	3	12	16	1490	0.69	5	15-20	8-12	Irrigation by flexible hoses in shortened furrows
					К	120	0.6	0.12		72	4320	4	23	39	1469	0.34	3			
03.Tad. (БОР)	Ю-I-Г	Г-II	III	non saline	О	120	0.6	0.4		24	1200	3	7.4	17	877	0.731	6	13-22	8-12	Close irrigation network. Irrigation through flexible hoses with differentiated water supply depending on furrow compaction
					К	120	0.6	0.15		41	3075	5	20.5	35	1230	0.4	4			
04.Tad. (БОР)	Ю-I-Г	Д-II	III	non saline	О	125	0.6	0.25	9	11.6	1393	1.3	5.4	12	1128	0.81	5	15-20	12	Close irrigation network. Irrigation through flexible hoses on background of preliminary deep ploughing to depth 0,6 (without layer turn out).
					К	125	0.6	0.12	11	26.4	1520	9.6	8	26	859	0.565	7			
Gradients from 0.0025 to 0.0075																				
15.Uz. (БОР)	Ю-I-Б	Б-III	II	non saline	О	50	0.6	0.3		2.8	1000	0.5	28.5		710	0.71	8	10-15		Irrigation through flexible hoses in shortened furrows.
					К	100	0.6	0.3		24	4320	4	60	16	864	0.2	3			
Gradients from 0.001 to 0.0025																				
03.Uz. (БОР)	Ц-II-А’	А-IV	IV	non saline	О	187	0.9	1.39		4.7	1402	1	34		911	0.65	4	19	7	Irrigation through flexible hoses with furrow flow regulation.
					К	203	0.9	0.55		45.5	4932	8	67	5	986	0.2	3			
01.Uz.(БОР)	Ю-I-Б	Б-IV	II	non saline	ОК	165	0.9	0.13		139	4212				2578	0.61	3	30-35		Irrigation special regime stabilizing subsidence processes.
						280	0.9	0.28		165	6600	15	55	10	1320	0.20	3			
01.Tur. (БОР)	Ю-I-А’	Г-IV	VII	non saline	ОК	100	0.9	0.7		3.9	1100	2	14		924	0.84	6	15		Irrigation from close network of asbesto-cement pipelines.
						200	0.9	0.7		11.8	1650	2	30	10	957	0.58	4			

Plot index	Soil-climatic zone	«Slope-permeability» index	Water allowance rayon	Soil salinity degree	Data type	$L_б$ [m]	a [m]	$q_б$ [l/s]	$t_{доб}$ [hour]	$T_{пол}$ [hour]	$m_{бр}$ [m³/ha]	Irrigation water technological expenses: evaporation [%]	Irrigation water technological expenses: infiltration [%]	Irrigation water technological expenses: release [%]	$m_{нт}$ [m³/ha]	Efficiency	Number of vegetation irrigation	Irrigation interval [day]	Area of simultaneous irrigation [hà]	Main methods of irrigation perfection and irrigation water use efficiency increase
Gradients less 0.001																				
16.Uz. (БОР)	Ц-II-Б	B-V	V	Strongly saline	O	420	0.9	0.75/ 0.25	12	34.8	1400	4	31		910	0.65	4	20-25		Irrigation through flexible hoses with differenciated regulation of irrigation jet phases of running of and moistening.
					K	420	0.9	0.5	19.6	77.7	3700	7	55	10	1036	0.28	3			
17.Uz. (БОР)	Ц-I-A'	B-V	VII	Slightly saline	O	400	0.9	0.5		6.3	314	0.5	11.5		276	0.88	11	4-14		Discrete regulation of water supply of small irrigation depth calculated for soil absorbing capacity. fragment irrigation by small gifts.
					K	400	0.9	0.51		24	1220	3	18	5	903	0.74	5			
02.Tur. (БОР)	Ц-I-A'	Г-V	VII	Slightly saline 3	O	100	0.9	0.7		3.9	1100	2	14		924	0.84	4	20-25		Contrary furrow irrigation on plots without slope, excluding irrigation water surface release
					K	200	0.9	0.7		11.8	1650	2	30	10	957	0.58	4			
05.Uz. (БОР)	C-II-A'	Г-V	V	Medium saline	O	200	0.9	0.92	2.3	5.6	1030	2	8		927	0.9	2	22	4	Contrary furrow irrigation on plots without slope, excluding irrigation water surface release
					K	200	0.9	0.82		7.2	1185	2	18		948	0.8	2			
20.Uz. (БОР)	Ц-I-A	Д-V	V	Strongly saline	O	250	0.9	1.2		6.6	1270	2	13				3	30-35	10	Contrary furrow irrigation on plots without slope, excluding irrigation water surface release, with one-dam irrigation canals

Explanations:

O- experimental data obtained during study of water saving methods and irrigation technique;
К- data on existing traditional furrow irrigation;

a – distance between furrows, [м];
$q_б$ – discharge into the furrow [l/s];
$t_{доб}$ – duration of irrigation jet running to the end of furrow, [hour];
$T_{пол}$ – total duration of irrigation, [hour];
$m_{нт}$ – irrigation depth net [m³/ha];
$m_{нт}$ – irrigation depth gross [m³/ha];

- staged irrigation under subsurface irrigation network from flexible hoses with differentiated water supply between stages and depending on compactness of furrow bed;
- irrigation from flexible hoses by shortened furrows;
- staged irrigation under subsurface irrigation network from flexible hoses with preliminary deep subsoiling of heavy soils 0.6 m in depth.

In zone of medium slope gradients (from 0.0025 to 0.0075):

- irrigation from flexible hoses by shortened furrows.

In zone of low slope gradients (from 0.001 to 0.0025):

- irrigation from subsurface network of conveying and stationary asbestos-cement pipes;
- irrigation from flexible hoses with furrow stream regulation;
- special regime of irrigation stabilizing subsidence processes.

In slopeless zone (<0.001):

- irrigation from flexible hoses with differentiated stream regulation during running-up and complete moistening (irrigation with variable discharge);
- frequent irrigation with discrete regulation of small irrigation depths, depending on soil absorption;
- "cross" furrow irrigation in the slopeless plots, which completely excludes surface release.

Assessment of effectiveness of cotton irrigation by furrows under conditions of the pilot plots as compared with control fields, where irrigation was done with existing technology, showed real possibility to increase efficiency of irrigation technique practically for all combinations "permeability-slope" (fig. 4.14):

In the zone of very high slope gradients (from 0.025 to 0.05) it averaged 28%:

- from 26% for soils with increased permeability.
- to 31% for high permeable soils

In zone of high slope gradients (from 0.0075 to 0.025) it averaged 34%:

- from 25.5% for low permeable soils
- to 40% for soils with increased permeability.

In zone of medium slope gradients (from 0.0025 to 0.0075) it averaged 51% for soils with increased permeability.

In zone of small slope gradients (from 0.001 to 0.0025) it averaged 34%:

- from 16% for low permeable soils
- to 45% for high permeable soils

In slopeless zone (<0.001) it averaged 22%:

- from 10% for low permeable soils
- to 37% for medium permeable soils.

4.2.3 Irrigation water expenses per yield unit and irrigation water productivity under cotton irrigation by furrows

Increase of irrigation technique efficiency in most cases was accompanied by increase of crop productivity. Average yield within all combinations "permeability-slope" (fig. 1.14) accounted for:

- 38.3 c/ha (minimum 19 c/ha - maximum 40 c/ha) in the pilot plots;
- 20 c/ha (minimum 12.5 c/ha - maximum 34 c/ha) in control fields.

Thus, average yield increase was 41.5%.

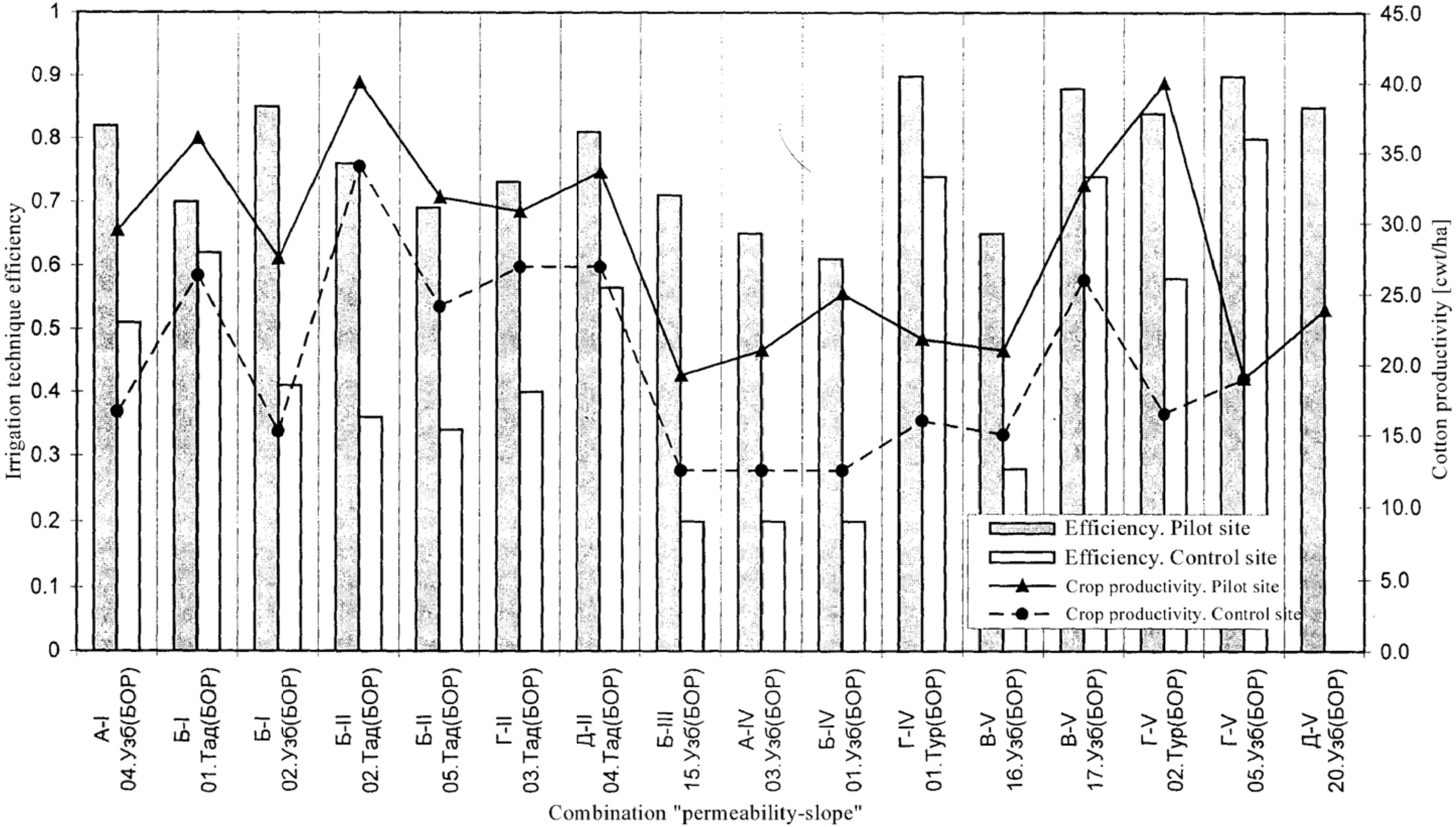

Fig. 4.14. Irrigation technique efficiency under furrow irrigation of cotton

Indicators of irrigation water expenses ("gross-field") per raw cotton yield and relevant indicators of irrigation water productivity should be assessed as applied to water allowance region, where the irrigated plot is located. In this connection conducted assessment was based on water allowance zoning. As a whole it showed the following (Appendix 4.5), (fig.4.15):

Under automorphous soils (groundwater table >3m) in water allowance zones:

I - thin loam on sandy-pebble sediments and thick sands

Pilot plots		Control fields	
Water expenses, [m^3/c]	Yield, [c/ha]	Water expenses, [m^3/c]	Yield, [c/ha]
249	25.3	880	14.6

II - medium thick loam on sandy-pebble sediments and thick sandy loam

Pilot plots		Control fields	
Water expenses, [m^3/c]	Yield, [c/ha]	Water expenses, [m^3/c]	Yield, [c/ha]
304	32.1	790	22.4

III - thick loam and clays

Pilot plots		Control fields	
Water expenses, [m^3/c]	Yield, [c/ha]	Water expenses, [m^3/c]	Yield, [c/ha]
221	32.2	426	26.9

Under soils of transition series (groundwater table 2-3 m):

V - loam and clays

Pilot plots		Control fields	
Water expenses, [m^3/c]	Yield, [c/ha]	Water expenses, [m^3/c]	Yield, [c/ha]
238	21	634	15.5

Under hydromorphous soils (groundwater table 1-2 m):

VI - light loam and sandy loam

Pilot plots		Control fields	
Water expenses, [m^3/c]	Yield, [c/ha]	Water expenses, [m^3/c]	Yield, [c/ha]
275	22	490	16

VII - loam and clays

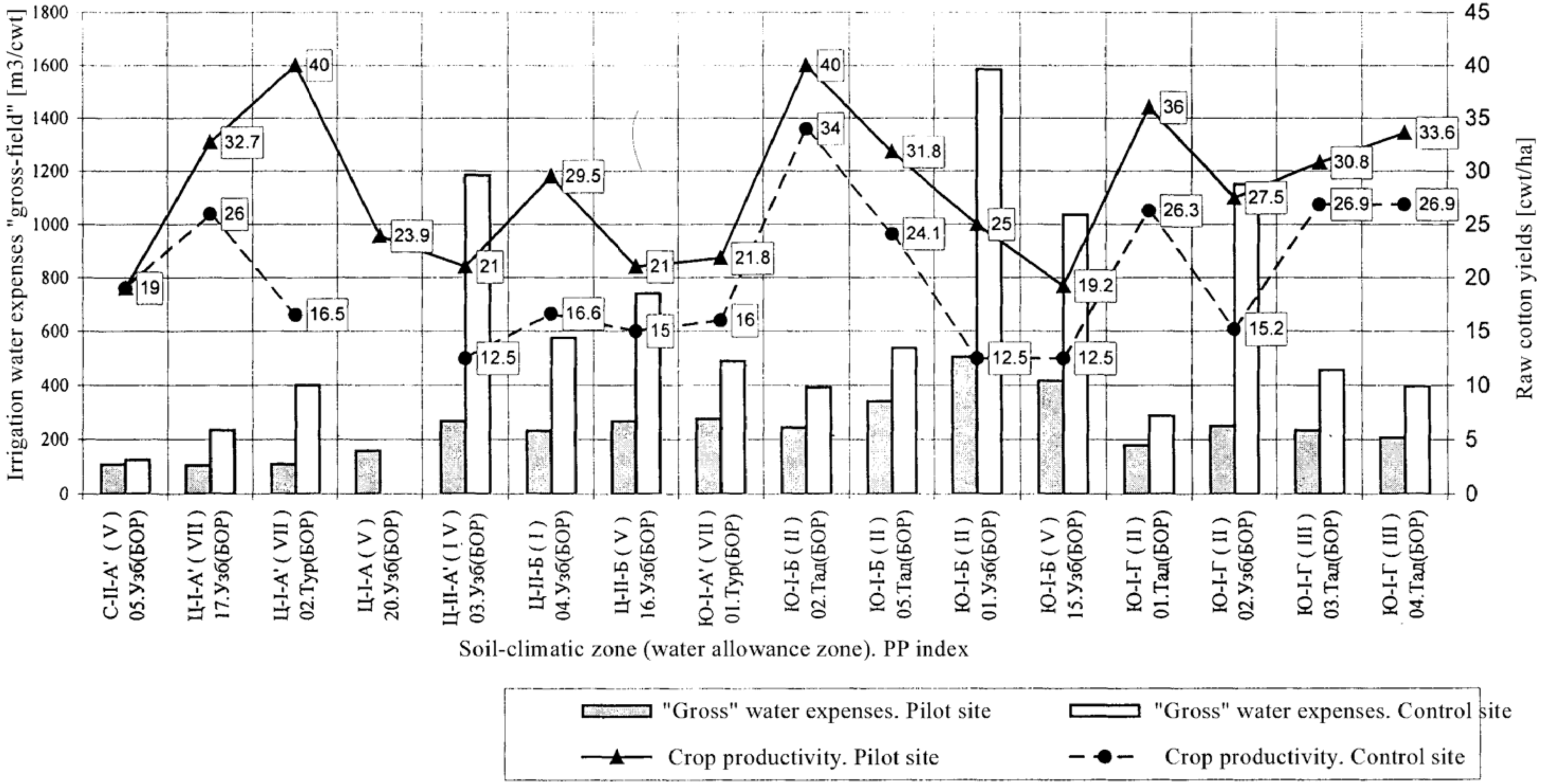

Fig. 4.15. "Gross" irrigation water expenses per cotton yield under furrow irrigation

Pilot plots		Control fields	
Water expenses, [m^3/c]	Yield, [c/ha]	Water expenses, [m^3/c]	Yield, [c/ha]
108	36.4	317	21.3

Thus, as compared to control values, decrease of specific irrigation water expenses per raw cotton yield ranged from 1.8 to 3.5 times. It is noticeable, that practically in all the plots yield level exceeded that achieved in control fields.

Analysis of irrigation water productivity indicator - "coverage" of irrigated water expenses by raw cotton yield (Appendix 4.6), (fig, 4.16) - shows the following. For most plots this indicator was 0.4-0.6 kg/m^3 against 0.05-0.25 kg/m^3 in control fields. Exception are those plots located under conditions of active participation of groundwater recharge in cotton water consumption (VII water allowance zone). Here, irrigation water productivity is about 0.9 kg/m^3, since 50% of cotton consumption is provided by groundwater.

4.2.4. Drip irrigation of cotton

Drip irrigation of cotton was studied in 7 plots (table 4.6).
Three of them have used Israeli irrigation modules with moisturizers equipped by "Katif" droppers (space between moisturizers - 1.8 m, dropper spacing - 0.7-1.0 m, dropper discharge - 2.0-2.3 l/hour, moisture regime - 0.7 of minimum moisture-holding capacity (MMC)).
Other three plots have used home-manufactured irrigation modules with moisturizers equipped by droppers "Vario-Drip" and "Agro-Drip" (space between moisturizers - 0.6-1.8 m, dropper spacing - 0.6-1.0 m, dropper discharge - 0.6-233 l/hour, moisture regime - 0.7-0.85 of MMC).
One plot has used microporous moisturizers "Dupon" (space between moisturizers - 0.9 m, 3000 pores per 1linear meter, dropper discharge - 4.3-5.0 l/hour, moisture regime - 0.65-0.75 of MMC), which were placed 0.15 m in depth under cotton rows.
Number of irrigations and, respectively, irrigation intervals ranged from 6 to 110 irrigations with depths of 65 to 665 m^3/ha in 1-8 days:

- "Katif" - 10-26 irrigations with depths of 96-430 m^3/ha in 10-26 days;
- "Vario-Drip" - 6-33 irrigations with depths of 123-665 m^3/ha in 2-7 days;
- "Dupon" - 83-110 irrigations with depths of 65 m^3/ha in 1 day.

Compared to furrow irrigation (control), increase of irrigation water productivity averaged 35.7% (minimum 27% - maximum 49%) (fig.4.17).

4.2.5 Irrigation water expenses per yield unit and irrigation water productivity under drip irrigation of cotton

Increase of irrigation technique efficiency in most cases was accompanied by increase of crop productivity. Average yield within all combinations "permeability-slope" (fig. 1.17) accounted for:

- 35.2 c/ha (minimum 24.2 c/ha - maximum 66 c/ha) in the pilot plots;
- 25.3 c/ha (minimum 17.0 c/ha - maximum 35.5 c/ha) in control fields.

Thus, average yield increase was 9.9 c/ha or 39.1%.

Table 4.6.

Comparative characteristics of cotton drip irrigation system

Pilot plot index	Soil-climatic zone	Index "gradient-permeability"	Water allowance region	Dripper type	Distance between horses	Distance between drippers	Moisture regime	Irrigation depth	Number of irrigations	Irrigation duration Irrigation duration	Irrigation interval	Dripper's discharge
					[м]	[м]	[part НВ]	[м³/ha]	[irrigation]	[hour /ha]	[day]	[l/hour]
04.Каз (КО)	С-II-Б	В-III	V	Katif	1.8	1.0	0.7 НВ	360-430	10-12	28-34	7-8	2.3
08.Узб (КО)	Ц-II-А’	Б-IV	VI	Vario-Drip	0.6-1.2	0.6-1.0	0.7 НВ	123-138	15-23	2.5-15	3-4	1.2-1.8
10.Узб (КО)	Ц-II-Г	А-I	I	Vario-Drip	1.2	0.9	0.85 НВ	175-183	33	31.5-32.9	2	0.6
19.Узб (КО)	Ц-I-В	Г-III	III	Katif	1.8	1.0	0.7 НВ	120-340	14-22	11-30	3-5	2-2.3
09.Тад (КО)	Ю-I-Б	Б-II	II	Micropore and Dupon	0.9	3000 микро-пор/п.м	0.65-0.75 НВ	65	83-110	2-10	1	4.3-5
09.Узб (КО)	Ю-I-Б	Б-IV	II	Katif	1.8	0.7	0.7 НВ	96-143	23-26	5.6-10	3	2.1-2.2
23.Узб (КО)	Ю-I-В	Б-III	VII	Vario-Drip Агро-Дрип	1.8	0.9	0.75-0.78 НВ	250-665	6-12	12.3-32.6	4-7	3.3

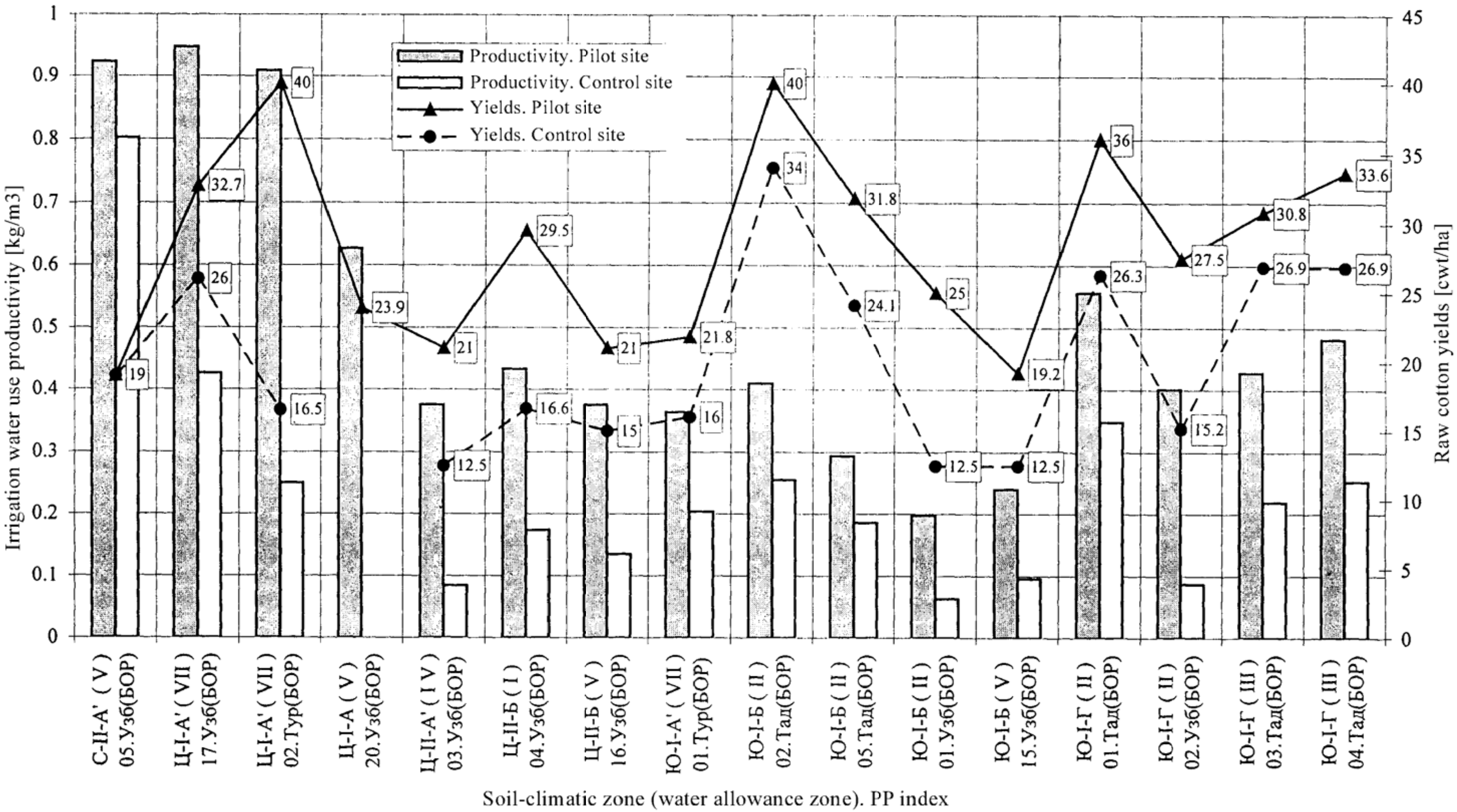

Fig. 4.16. Irrigation water productivity under cotton furrow irrigation at a field level

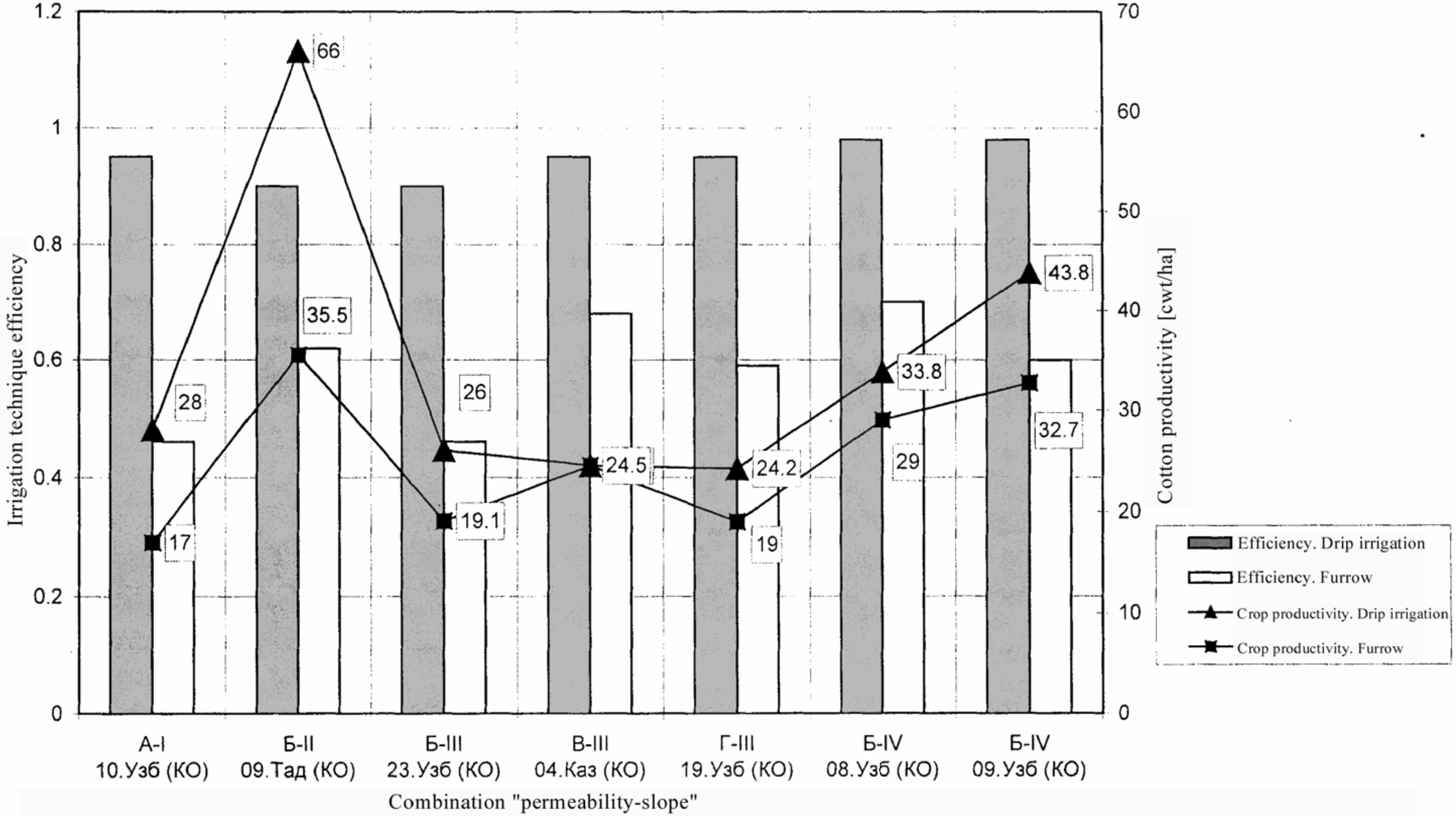

Fig. 4.17. Irrigation technique efficiency under drip irrigation of cotton compared to furrow irrigation

Assessment of indicators of irrigation water expenses ("gross-field") per raw cotton yield and relevant indicators of irrigation water productivity (fig. 4.18) showed the following:

specific expenses (gross-field) per cotton unit yield:

- drip irrigation - 126.6 m^3/c (minimum 71 m^3/c - maximum 163.3 m^3/c);
- furrow irrigation (control) -339.5 m^3/c (minimum 185.7 m^3/c - maximum 705.9 m^3/c);

irrigation water productivity:

- drip irrigation - 0.92 kg/m^3 (minimum 0.43 kg/m^3 - maximum 1.41 kg/m^3);
- furrow irrigation (control) - 0.36 kg/m^3 (minimum 0.23 kg/m^3 - maximum 0.54 kg/m^3).

Well-known advantage of drip irrigation is that it allows to approximate, as much as possible, irrigation regime to daily evapotranspiration. Frequent waterings with small depths not exceeding crop water requirements and meeting soil water-bearing ability, application with irrigation water of soluble fertilizers create conditions required for appropriate crop development. There is relation between crop yield growth and irrigation intervals (accordingly, depth of irrigation) (fig.4.19). Best results were achieved under irrigation intervals not exceeding 3 days.

4.2.6 Drip irrigation of vines and orchards

Drip irrigation of vines and orchards was studied in 6 PP (table 4.7).
Three of them used home-manufactured irrigation modules with moisturizers equipped by droppers "Moldaviya-1" and similar dropers VNIIVodpolimer (space between moisturizers - 3m, dropper spacing - 2.5 m, dropper discharge - 4.0-18.0 l/hour, moisture regime - 0.7-0.85 of MMC).
Other three plots used drip irrigation systems developed by researchers from Tadjikistan (space between moisturizers -2 m, dropper spacing - 2 m, dropper discharge - 4-70 l/hour, moisture regime - 0.7 of MMC).
Number of irrigation and, accordingly, irrigation intervals ranged from 20 to 44 irrigations with depths of 38-510 m^3/ha in 2-10 days:

- vines (droppers "Moldaviya-1") - 20-28 irrigations with depth of 38-510 m^3/ha in 3-10 days;
- pomegranates (microoutlets) - 21-23 irrigations with depth of 460-510 m^3/ha in 6-7 days;
- apples (microoutlets "Tadjikistan") - 44 irrigations with depth of 100 m^3/ha in 2-4 days.

As compared with furrow irrigation (control field) increase of irrigation water productivity under vines irrigation averaged 22% (minimum 13% - maximum 28%) (fig. 4.20).

4.2.7. Irrigation water expenses per yield unit and irrigation water productivity under drip irrigation of vines

Average yields in the plots under vines cultivation (fig. 4.20) accounted for:

- drip irrigation - 138.5 c/ha (minimum 95.7 c/ha-maximum 186.7 c/ha);
- furrow irrigation (control field) - 75.2 c/ha (minimum 53.8 c/ha-maximum 90.0 c/ha).

Average yield increase was 63.3 c/ha (84%), i.e. drip irrigation is highly suitable for crops.
Assessment of indicators of irrigation water expenses (gross-field) per vine yield and relevant indicators of irrigation water productivity (fig. 4.18) showed the following:

Table 4.7.

Comparative characteristics of gardens and vineyards drip irrigation systems

Pilot plot index	Soil-climatic zone	Index "gradient-permeability"	Water allowance region	Dripper type	Distance between horses	Distance between drippers	Moisture regime	Irrigation depth	Number of irrigations	Number of irrigations	Irrigation interval	Dripper's discharge
					[м]	[м]	[part HB]	[м^3/ha]	[irrigation]	[hour /ha]	[day]	[l/hour]
06.Узб (КО)	Ц-II-В	А-I’	I	Moldavia-1	3 (вин)	2.5	0.85 HB	160-190	27-28	6-10	5	15-18
07.Узб (КО)	Ц-II-В	Б-I’	II	Moldavia-1 VNII Vodo-polimer	3 (вин)	2.5	0.7-0.85 HB	150	23-28	12	4-5 (I half vegetation) 9 (II half vegetation)	9.3-9.5
22.Узб (КО)	Ц-II-В	В-I’	III	Moldavia-1	3 (вин)	2.5	0.7-0.8	38-81	20	4.75-10.1	3-10	4-8
08’’.Тад (КО)	Ц-II-Г	А-I	I	Micro water releases Tadji-kistan	(вин)							
07.Тад (КО)	Ю-I-Г	Б-I’	II	Outlet tubes to each shtamb	2 (pome-granate)	2	0.7	460-510	21-23	4-10	6-7	30-70
08’.Тад (КО)	Ю-II-Д	В-I’	II	Micro water releases Tadji-kistan	(apple)	2	0.7	100	44	7.5-15	2-4	4-8

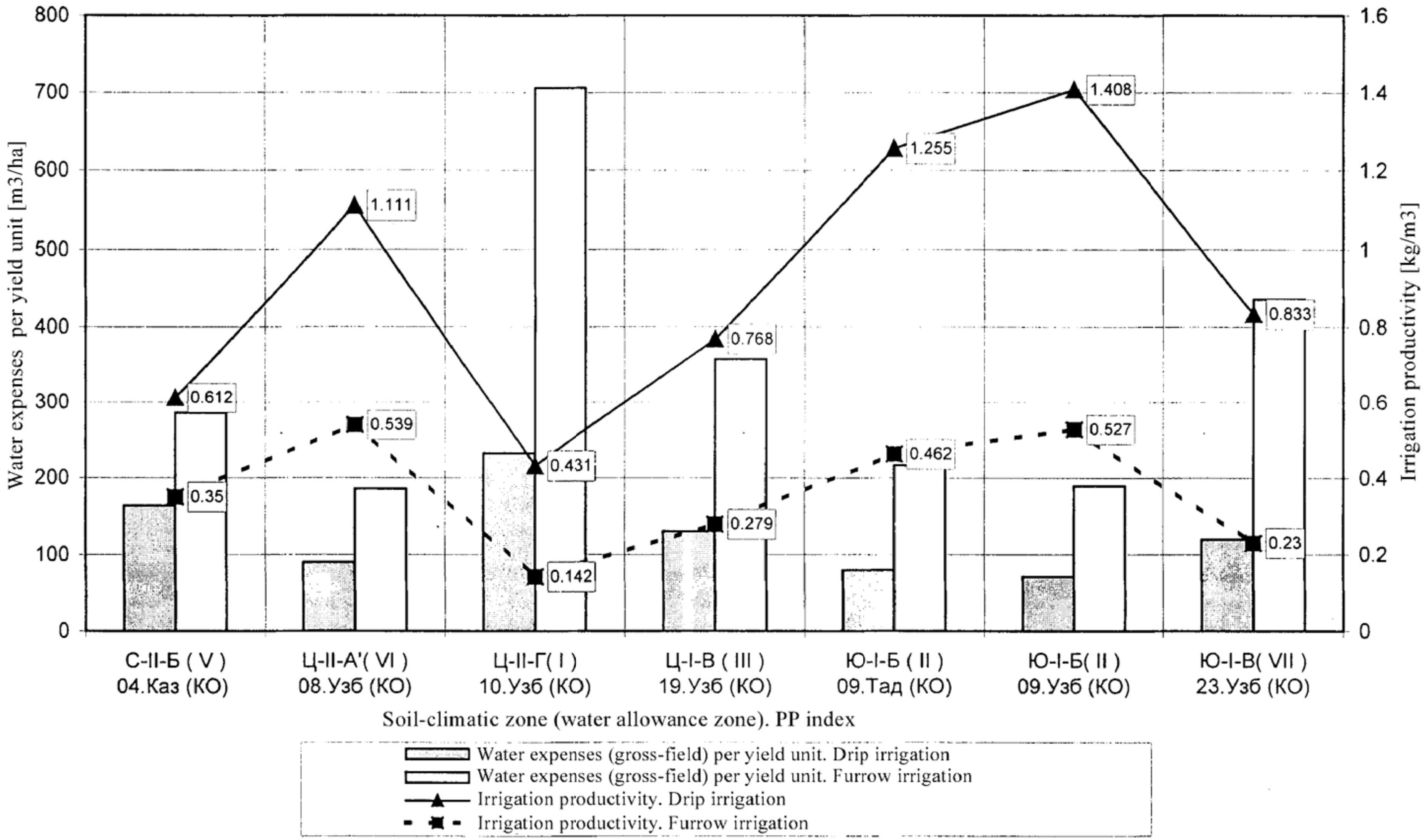

Fig. 4.18. Irrigation water expenses per yield unit and productivity of cotton drip irrigation

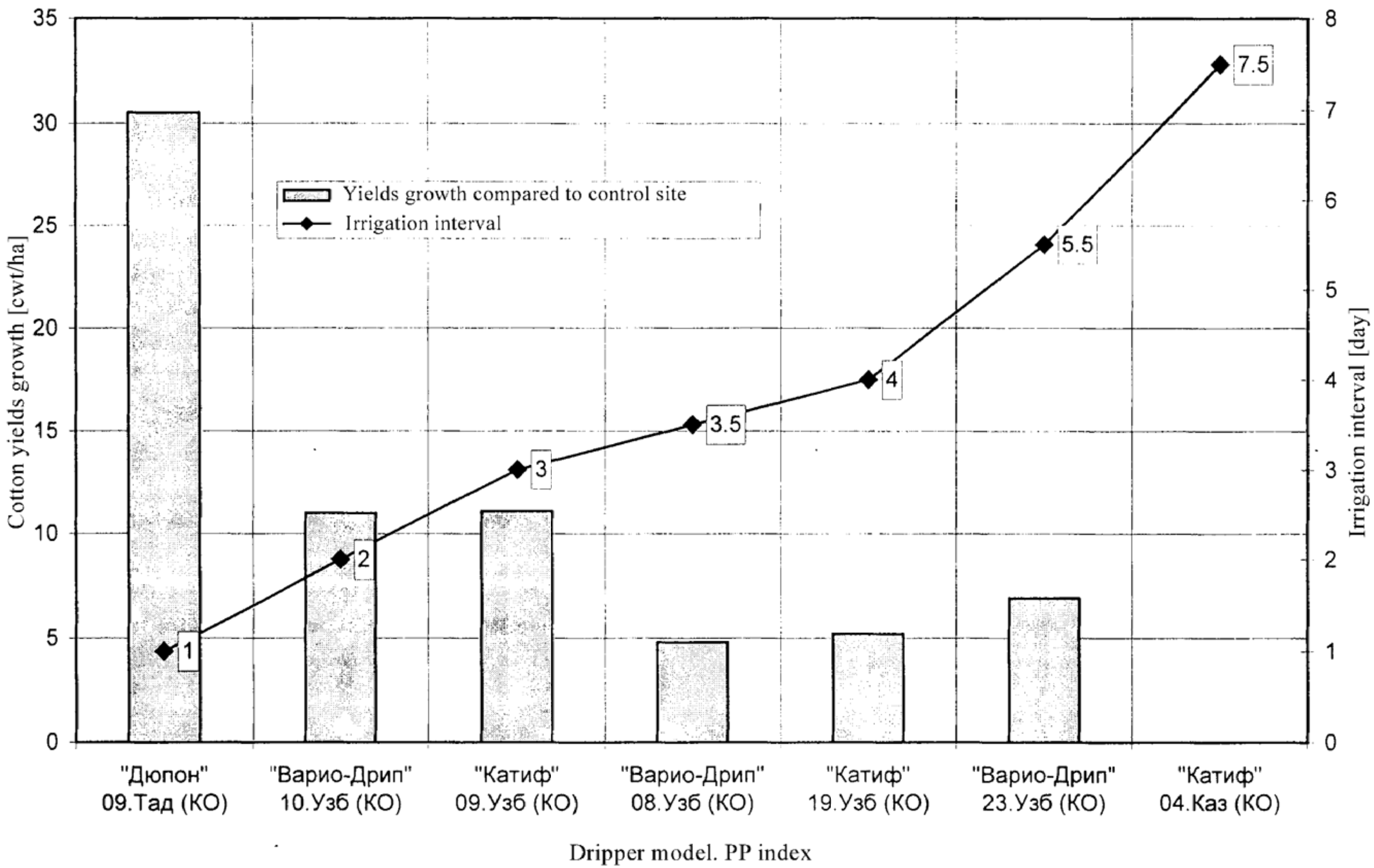

Fig. 4.19. Relation of yield gowth under drip irrigation of cotton with irrigation intervals

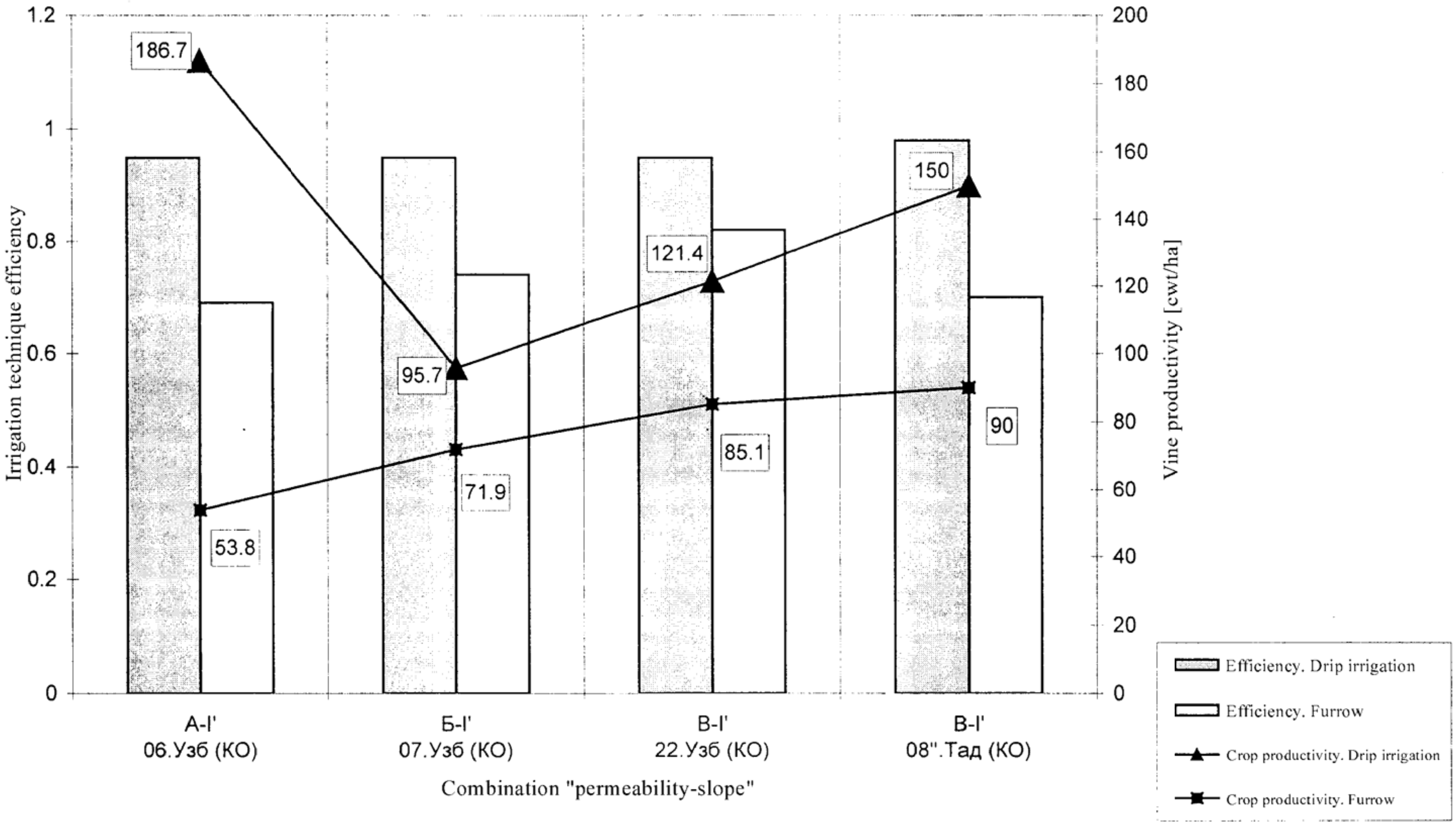

Fig. 4.20. Irrigation technique efficiency under drip irrigation of vines compared to furrow irrigation

specific expenses (gross-field) per vine unit yield:

- drip irrigation - 26.5 m^3/c (minimum 13.2 m^3/c - maximum 40.0 m^3/c);
- furrow irrigation (control) -82.2 m^3/c (minimum 41.9 m^3/c - maximum 132.9 m^3/c);

irrigation water productivity:

- drip irrigation - 4.6 kg/m^3 (minimum 3 kg/m^3 - maximum 7.6 kg/m^3);
- furrow irrigation (control) - 1.59 kg/m^3 (minimum 0.75 kg/m^3 - maximum 2.4 kg/m^3).

Research data is of importance from the positions of slope irrigation productivity increase, where drip irrigation is beyond of comparison as use of other irrigation methods is connected with erosion processes.

4.2.8. Sprinkler irrigation of cotton

Three PP used sprinkler irrigation by frontally moved sprinklers (table 4.8) having coverage from 100 m (DDF) to 778 m ("Kuban"). Number of irrigations ranged from 3 to 7 with depth of 410-1150 m^3/ha in 15-28 days. Moisture regime was 0.63-0.78 of MMC. Discharge was 30 l/sec for DDF and 170 l/sec for "Kuban", duration of irrigation per 1 ha was 0.35 hour and 11 hours, respectively. As compared with furrow irrigation, increase of irrigation water productivity averaged 22% (fig.4.21). Yield increase respectively accounted for 3-5 c/ha, i.e. not so high. Decrease of irrigation water expenses per yield unit ranges from 8.1 to 253.3 m^3/c (Appendix 4.5).