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МУНДАРИЖА | СОДЕРЖАНИЕ | CONTENT

АГРО ПРОЦЕССИНГ
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GENERAL STATE OF THE PROBLEM OF USING NON-TRADITIONAL IRRIGATION METHODS FOR THE PURPOSE OF WATER CONSERVATION AND SOIL PROTECTION FROM DEGRADATION

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ABSTRACT

The scientific article is devoted to an urgent problem - the water supply of lands for irrigated agriculture in conditions of scarcity of water resources on lands prone to degradation. Field experiments were carried out with various irrigation methods: furrow irrigation, sprinkling and drip irrigation. Despite the apparent effectiveness of the last two methods of irrigation, a cheap, simple and reliable method of surface irrigation has become widespread on farms in Uzbekistan: furrow irrigation.

The particular significance of this article is that it has been experimentally proven that by improving furrow irrigation it is possible not only to obtain high crop yields at lower costs of water resources, but also to protect soils from degradation. The article outlines trends in the direction of research to create a concept of water saving when irrigating in furrows:

- development of theoretical and practical implementation of optimization of the values of elements of furrow irrigation technology;
- improvement of outdated furrow designs and cutting them in different directions along the slope;
- minimizing soil tillage and soil protection measures;
- on amelioratively disadvantaged lands and in conditions of emerging difficulties in developing and irrigating lands in the Adyr zone, it is necessary to use the biological properties of drought, salt and wilt resistance of new varieties of cotton, corn and search for an optimal irrigation regime for them for various natural, economic and climatic conditions of the republic;
- widespread use of various mulching materials in the form of polyethylene film, polymers for water conservation, soil protection from erosion when irrigating along furrows;
- creation of lightweight portable irrigation means for irrigation along furrows on large and steep slopes: corrugated, polyethylene pipes, hoses, portable trays, i.e. equipping farmers with small-scale mechanization and irrigation automation.

The article may be useful for students, masters, graduate students, teachers and water management specialists.

Keywords: Water consumption, water-saving technologies, saline lands, land degradation, furrow irrigation.

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ОБЩЕЕ СОСТОЯНИЕ ПРОБЛЕМЫ ИСПОЛЬЗОВАНИЯ НЕТРАДИЦИОННЫХ МЕТОДОВ ОРОШЕНИЯ В ЦЕЛЯХ ВОДОСБЕРЕЖЕНИЯ И ЗАЩИТЫ ПОЧВ ОТ ДЕГРАДАЦИИ

АННОТАЦИЯ

Научная статья посвящена актуальной проблеме – водоснабжению земель орошаемого земледелия в условиях дефицита водных ресурсов на землях, склонных к деградации. Полевые опыты проводились с различными способами орошения: поливом по бороздам, дождеванием и капельным орошением. Несмотря на кажущуюся эффективность двух последних способов орошения, в хозяйствах Узбекистана получил распространение дешевый, простой и надежный метод поверхностного орошения – бороздковый полив.

Особая значимость данной статьи состоит в том, что экспериментально доказано, что за счёт улучшения бороздкового орошения можно не только получить высокие урожаи сельскохозяйственных культур при меньших затратах водных ресурсов, но и защитить почвы от деградации. В статье обозначены тенденции направления исследований по созданию концепции экономии воды при поливе по бороздам:

- разработка теоретической и практической реализации оптимизации значений элементов технологии бороздкового полива;
- усовершенствование устаревших конструкций борозд и нарезка их в разных направлениях по склону;
- минимизация обработки почвы и почвозащитных мероприятий;
- на мелиоративно-неблагополучных землях и в условиях возникающих трудностей освоения и орошения земель адырной зоны необходимо использовать биологические свойства засухоустойчивости, солеустойчивости и вилтоустойчивости новых сортов хлопчатника, кукурузы и поиск оптимального режима орошения для различных природных, экономических и климатических условий республики;
- широкое использование различных мульчирующих материалов в виде полиэтиленовой пленки, полимеров для водосбережения, защиты почвы от эрозии при поливе по бороздкам;
- создание легких переносных оросительных средств для полива по бороздам на больших и крутых склонах: гофрированных, полиэтиленовых труб, шлангов, переносных лотков, т.е. оснащение аграриев средствами малой механизации и автоматизации полива.

Статья может быть полезна студентам, магистрам, аспирантам, преподавателям и специалистам водного хозяйства.

Ключевые слова: Водопотребление, водосберегающие технологии, засоленные земли, деградация земель, бороздковый полив.

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1 Introduction

In Central Asia, water is becoming an increasingly limited factor in the development of the economy and agriculture. Mutual claims by the Central Asian republics regarding the unregulated use of water resources, mainly ground water, cause even greater concern in conditions of scarcity of irrigation water when using its reserves in irrigation sources in addition to low water periods, observant managers for 3-4 years. Water management specialists are concerned about forecasts for climate warming on the planet and the worsening process of desertification of lands, including all the republics of Central Asia. On developed lands, soil salinization is underway.

In Uzbekistan, 1948 thousand hectares (45.3%) of irrigated lands have varying degrees of salinity, of which 1337 thousand hectares (31.1%) are slightly saline, 524.6 thousand hectares (12.2%) are moderately saline, 86 .0 thousand hectares (2%) are highly saline, on 24.4% of the area groundwater is at a level of 2 meters or higher. As can be seen, almost half of the land is under threat of soil degradation. An analysis of research in recent years shows that out of 2.352 million hectares of land, 591 thousand hectares are currently susceptible to erosion. Along with the soil, fertilizers and soil nutrients are washed away (Table 1.).

2 Methods and Materials

The purpose of the study is to explore the possible benefits and applications of different irrigation methods. The results of the study were obtained on the basis of field research conducted using the methodology for conducting field research on the SANIIRI irrigation technique, assumptions and analysis of foreign literature. The study used monographic, abstract-logical, comparative and other methods [1].

3 Results and Discussion

At the moment, slightly washed away soils are registered - 315.6 thousand hectares, moderately washed away - 224.0 thousand hectares, heavily washed away - 51.4 thousand hectares. There is no need to note that irrigation under these conditions is carried out with discharge and filtration losses, up to 46-68% of them enter the collector-drainage network and from there into rivers. 90% of waste water contains salts, plant protection chemicals, fertilizers, microelements, and organic substances. This process goes from the beginning of the Aral Sea basin all the way to the sea itself.

Table 1. Annual loss of nutrients with soil mass along with waste water from fields (kg/ha), observed at key observation points in the irrigated zone of the foothills of Uzbekistan in the cotton growing zone

№	Object location foothill irrigation zone	Soil type, mechanical composition	Reset water from the site, %	Flush finely earth, t/ha	Nutritious elements		
					humus	nitrogen	phosphorus
1	2	3	4	5	6	7	8
1	Tashkent region, Parkent district, Boykazan farm	dark gray soil, heavy loam	48 59	13 24	260 490	113,2 24,5	22,5 40,8
2	Kashkadarya region, Kitab district, subsidiary farm Gisarakgidrostroy	dark gray soil, heavy loam	47 52	21 59	267 528	15,2 42,1	32,8 94,7
3	Tashkent region, Yangiyul district, Tinchlik mine	typical gray soil, medium loam	35 48	19 51	220 510	14,1 37,7	30,4 81,6
4	Tashkent region, Tashkent district, Keles farm	dark gray soil, heavy loam	42 58	15 21	214 300	14,7 20,6	30,1 63,2
5	Fergana region, Fergana district, farm named after. Tursunkulova	dark gray soil, heavy loam	38 52	11 17	107 165	13,8 21,4	15,3 23,8
6	Namangan region, Namangan district, Turakurgan pumping station, Tadbirkorlik farm	grey-brown-stony, light loam	34 44	29 46	185 294	20,3 32,2	7,5 11,9
7	Namangan region, Uychinsky district, farm named after Akhunbabaev	light gray soil, light loam	17 54	17 38	66 148	5,9 13,3	10,2 22,8
8	Andijan region, Assaka district, farm named after Tursunov	dark gray soil, heavy loam	19 55	18 36	245 489	25,2 50,4	4,5 9,0
9	Kashkadarya region, Kasansan district, “Surkhan” farm	light gray soil, sandy loam	22 40	20 42	106 223	6,0 12,6	22,0 46,2

Given this situation, one should take into account the development of a concept for a water saving strategy, where the most vulnerable place in the water distribution and water consumption system is the field.

Currently, the growth of irrigated land has stopped. However, the issue of water conservation using water-saving irrigation technologies, which can be carried out during the reconstruction of irrigated lands, taking into account the resuscitation of drainage systems, is not removed from the agenda. In this regard, the reserves for the growth of irrigated lands due to these measures and the total irrigated area can be reached up to 4965 thousand hectares.

When carrying out the growth of new lands after the reconstruction of an irrigated and drained field, you can focus on the areas shown in Table. 3. at higher and lower soil quality levels. The development of new lands can be carried out by increasing the efficiency of use of all sources of water resources: groundwater, surface and atmospheric waters.

Table 2. Areas of land potentially suitable for irrigation and planned areas of possible land growth based on new irrigation on the available water reserves of the republic when implementing a full range of measures for reconstruction and introduction of water-saving technologies

Administrative units	Existing irrigated area, thousand hectares	In addition, potentially suitable for irrigation, thousand hectares	Possible increase in new irrigated areas, thousand hectares	Irrigated area that can be obtained, thousand hectares
Karakalpakistan	502,2	1540	135	637,2
Andijan region	285,4	70	15	300,4
Bukhara region	346,2	1700	62,5	408,7
Jizzakh region	289,3	560	26	315,3
Kashkadarya region	490,2	1320	305,3	795,5
Namangan region	274,1	90	15	289,1
Samarkand region	405,4	870	40	446,1
Surkhandarya region	313,7	170	85	398,7
Syrdarya region	299,5	150	18	317,5
Tashkent region	400,0	170	15	415
Fergana region	358,2	150	15	373,2
Khorezm region	261,2	240	8,2	269,3
Total for the Republic of Uzbekistan	4225,2	7030	740	4965,3

Table 3. Possible areas of growth of new irrigated lands in the republic on available water resources when implementing a full range of measures for reconstruction and introduction of water-saving technologies

Administrative units	Possible increase in new irrigated areas	Including fertility	
		Highly fertile	Reduced fertility
Karakalpakistan	135	70	65
Andijan region	15	-	15
Bukhara region	62,5	62,5	-
Jizzakh region	26	-	26
Kashkadarya region	305,3	250	55,3
Namangan region	15	-	15
Samarkand region	40	40	-
Surkhandarya region	85	30	55
Syrdarya region	18	-	18
Tashkent region	15	15	-
Fergana region	15	-	15
Khorezm region	8,2	-	8,2
Total for the Republic of Uzbekistan	740	467,5	272,5

Given the noted shortage of irrigation water, water consumption in Uzbekistan occupies far from the last place. For example: water consumption in Canada is 109,000 m^3 per capita, in Russia - 15,000 m^3, in the USA - 10,000 m^3, in Uzbekistan - 2860 m^3, in Israel - 382 m^3, in Saudi Arabia - 254 m^3. According to the UN FAO, for the sustainable development of the country's agriculture, 1000 m^3 of water per capita is needed.

In the Aral Sea basin, water reserves amount to 120 km^3, Uzbekistan accounts for 70 km^3, of which, mainly, river flow is 63 km^3. An irrigation network with a length of 180 thousand km takes 54-56 km^3, while 38-44 km^3 of water reaches the field, and 25-28 km^3 of water reaches the plants. Thus, it can be argued that in irrigation systems there are unproductive losses of water, both due to organizational and technical reasons and imperfections in irrigation technology.

Although the area of Uzbekistan is 44.7 million hectares, only 4.3 million hectares are under agricultural land. According to soil scientists, the area of farmland could be expanded by 7.5 million hectares without special reclamation measures and with water reserves, using moisture from precipitation. Currently, the water flow from precipitation falling in the mountains and in the foothill zone of adyr lands is 24-49% in conditions of moderate and heavy rainfall. Water goes into ravines, mudflow channels, and into depressions in the relief.

Let us note that the area of arable land in Uzbekistan is 4.3 million hectares, in Egypt – 2.8 million hectares, in Israel – 0.44 million hectares, in Saudi Arabia – 0.44 million hectares. In the designated areas, content with low water consumption, but with the help of high-tech irrigation methods, these countries grow and export grain, citrus fruits, vegetables, and even flowers. Therefore, the main issue in the strategy of water conservation and measures for the use of water resources is, first of all, the delivery of water to the field, and then its rational use on the irrigated field, while combining the rational placement of the crop structure not only according to the quality of the soil, but also taking into account the relief features, i.e. linking irrigation processes in the mountain-foothill and adyr zones with irrigation processes occurring in the plain-steppe zone. Such a discrepancy showed negative aspects: flooding of underlying lands located next to the adyr elevations of hilly lands (Jalalkuduk, Markhamat in Andijan, Pap and Zadarya in Namangan, Arsif in Fergana regions).

On average in Uzbekistan, irrigation norms are 14 thousand m^3/ha, the moisture content in the soil and the consumption of the created moisture reserve by plants from the soil is 3.5 thousand. Thus, if we take into account that in the plain-steppe zone, in order to avoid the process of secondary salinization, another 2.5-4 thousand m3/ha is required, then the irrigation rate for irrigating cotton reaches up to 8 thousand m3/ha, therefore, the remaining 6 thousand m^3/ha are water losses that feed groundwater. Therefore, the issue of combating water losses in the on-farm irrigation network is relevant, the elimination of which relieves the burden on the excessive operation of the drainage network on the farm. In a market economy, it is important to provide farmers and dehkans with accessible irrigation techniques that increase the efficiency of farming, as well as techniques to combat soil salinization and control erosion.

Therefore, we conducted field experiments aimed at minimal expenditure of material resources and resources by farmers and dekhkans, especially on steeply sloped lands, where soil erosion occurs at an intensive rate (Table 1.), and on highly saline, heavy loamy soils of takyr-type soil varieties with the absence of drainage systems. in an area with difficult outflow of groundwater, but with increased capillary supply of the upper layers of soil from mineralized groundwater with a rise in their level up to 1 m during the growing season.

Research was carried out on the best use of moisture reserves in the soil from precipitation on upland slopes with a slope of 0.08-0.11 on winter grain crops (Kroshka wheat) and irrigation of the re-crop - corn, after harvesting the wheat, with using irrigation trays with hydrant extinguishers when supplying water along the greatest slope instead of ok-aryks. Watering was carried out along the jockey furrows.

And in the lower flat areas, where there was a threat of rising groundwater levels and soil salinization, cotton of the Bukhara-6 variety was sown. To maintain an optimal irrigation regime for cotton, sowing under film was used with the expectation of maintaining the process of reducing the concentration of salt solution in the soil in the root system zone, as well as the effect of the desolenizer drug from the Swiss company Sibo Sper Sal.

The results obtained reflect two directions: the first is the fight against soil erosion using anti-erosion furrow structures: jockey, contour irrigation and K-9 polymer. And secondly, reducing the effect of filtration water losses from irrigation of elevated areas, which cause a rise in groundwater levels and soil salinization, by maintaining moisture reserves in the soil due to the exclusion of moisture evaporation under the film and the action of the drug Sper Sal.

From the table Figure 4 shows that mountain lands under agricultural crops in our republic are located at an altitude of 750-3500 m above sea level with the presence of precipitation for rainfed farming of 350-800 mm (3.5-8 thousand m3/ha), but with the lowest average temperature air with a guideline for cultivating crops with a short growing season.

Table 4. Distribution of soil area according to plan-elevation location on the territory of the Republic of Uzbekistan (Khamraev N.R., 2000)

Altitude above sea level, m	Area, thousand hectares	Soils	Presence of osaks, mm	% of agricultural area
3500-2800 2800-1200 1200-750 750-500 500-250 3500-250	540 1662 1055 3051 4121 10420	Light brown Brown, brown Dark gray soil Typical gray soil Light gray soil Meadow-gray earth	>800-1000 800-500 500-350 350-280 280-250	1,97 6,10 3,80 11,10 15,0 38,1
Total flat lands	16963			61,9
Total for the republic	2739			100

Table 5. Altitudinal distribution of irrigated lands by regions of the Republic of Uzbekistan (data from Uzgiprozemkadastr)

№	Regions of the republic	Irrigation area, thousand hectares	Altitude above sea level, m					
			80-120	120-250	250-500	500-750	750-1200	1200-2800
1 2 3 4	Tashkent Andijan Namangan Fergana	300 224 207 280	- - - -	- - - -	70 30 - -	120 60 50 50	100 110 107 180	10 24 50 50
	Total	1011	-	-	100	280	497	134

Considering the difficulty of irrigating furrows of row crops on steep slopes and in the complex terrain of the adyr farming zone, the influence of erosion and soil degradation, farming of low-water-intensive crops is preferable. Currently, 29.9% of the lands occupied by agricultural crops are located on adyr lands, foothill sloping slopes at an elevation of 750-250 m. Research was carried out in the following regions: Tashkent, Andijan, Namangan, Fergana. Based on the results, 1011 thousand hectares were defined as irrigation areas with unsecured, semi-secured and provided precipitation along an altitude zone of less than 250 m, 250-750 m, 750-2800 m above sea level (Table 5).

SANIIRI has accumulated experience in studying various irrigation techniques using non-traditional irrigation of sloping lands.

For example, a study of the influence of various irrigation methods on alfalfa yields showed that sprinkling makes it possible to improve the uniformity of moisture and reduce the timing of irrigation, which leads to rapid growth and development of alfalfa. The above factors contributed to an increase in yield compared to flood irrigation by 62 c/ha (Table 6) at the Dustlik farm in Tashkent region.

Table 6. The influence of different irrigation methods on alfalfa yield

Watering method	Number of cuts	Yield by mowing, c/ha					Savings, c/ha
		3rd	4rd	5rd	6rd	Total	
Sprinkling	6	56,0	53,0	42,0	31,0	182,0	62,0
Slouchy	5	43,0	39,0	38,0	-	120,0	-

Table 7. Comparative irrigation regime for wheat with sprinkling and furrow irrigation

Watering method	Timing and irrigation rate, m^3/ha				Irrigation rate	Saving irrigation water
	1 watering	2 watering	3 watering	4 watering		
Sprinkling	300,0 10.03	400,0 30.03	600,0 20.04	300,0 14.05	1600,0	1600,0
Sprinkling	300,0 10.03	400,0 1.04	600,0 22.04	300,0 16.05	1600,0	
Sprinkling	300,0 10.03	400,0 1.04	600,0 22.04	300,0 16.05	1600,0	
Along the furrows	-	1520,0	980,0	700,0	3200,0	-
Along the furrows	-	1470,0	1020,0	680,0	3170,0	
Along the furrows	-	1380,0	1140,0	780,0	3300,0	

As can be seen from the table, when sprinkling, the number of irrigations increased compared to furrow irrigation, but in general, water savings per hectare amounted to 1600 m^3/ha of irrigation water (with almost equal water consumption), i.e. 50%. Labor productivity in the irrigation area with the DDF-100 machine was 13 times higher, and cotton yield was 5 c/ha higher.

Speaking about sprinkling, we should not forget that this is always a specific technique. The capabilities of technology are different, as evidenced by the following data (Table 8). From the table it follows that the simplest, and at the same time with the lowest rain characteristics, the DDF-70 sprinkler allows you to save up to 50% of irrigation water compared to manual furrow irrigation and increase cotton yield by 7.7%, and the sprinkler "Valley" allows you to save up to 60% of water and increase productivity by 26.2%. And although these data are average, they give an idea of the capabilities of modern sprinklers.

Table 8.

№	Types of sprinklers	Productivity, ha/day	Irrigation uniformity, Ksh*Kd	Water savings from the benchmark	Yield from standard
1	STANDARD – manual non-mechanized irrigation (taken as the unit of comparison, numerator)	1 0,5	Kp=0,2 Ksh=0,4 Kd=0,5	1	1
2	Long-range jet machine DDN-70	11 5,5	Kp=0,42 Ksh=0,65 Kd=0,65	1,4	1,077
3	Long-range front jet machine DFD-80	13 6,5	Kp=0,52 Ksh=0,65 Kd=0,80	1,4	1,112
4	Wide-range long-range DNA-80	13 6,5	Kp=0,42 Ksh=0,65	1,4	1,077

			Kd=0,65*		
5	Wide-cut medium jet "Volzhanka"	11 5,5	Kp=0,56 Ksh=0,75 Kd=0,75	1,5	1,126

The drip irrigation system in the foothill zone is considered progressive, especially for orchards and vineyards on pebble filter soils. The cost of non-traditional irrigation methods is high compared to furrow irrigation, but increasing water shortages force us to turn to water-saving irrigation methods for recommended plant species (Tables 9 and 10).

Table 9. List and technical and economic indicators of irrigation methods

№	Irrigation method and technical means	Transpiration, % of evapotranspiration	Physical evaporation, %
1	Irrigation in furrows using portable fixtures	0,74	5
2	The same, using flexible and rigid pipelines	0,78	8
3	Irrigation in furrows using automatic irrigation trays	0,78	35
4	Surface irrigation in strips	0,72	5
5	Surface irrigation by flooding checks	0,82	20
6	Sprinkling with mobile machines	0,80	30
7	Sprinkling with stationary systems	0,85	25
8	Synchronized pulse sprinkling	0,90	25
9	Drip irrigation of gardens, vineyards	0,95	12
10	Drip irrigation for row crops	0,95	12
11	Subsoil irrigation	0,98	5
12	Discrete furrow irrigation	0,85	35

Table 10. Changes in cotton water consumption depending on irrigation method.

Irrigation method	Average humidity, % PPV		Evapotranspiration lobe to sulcal watering	Transpiration, % of evapotranspiration	Physical evaporation, % of total evaporation
	on top ness	Korneobi meltable layer			
Borozdkovoe	50	80	1,00	57,00	43,00
Sprinkling	58	75	1,03	46,00	54,00
Subsoil	25	85	0,92	67,00	33,00
Drip	25	85	0,71	87,40	12,60

Table 1.11. Approximate depth of the calculated soil moisture layer for the main crops using the drip irrigation method.

Culture	Development phase	Depth settlement layer, cm
Cotton	budding bloom maturation	40-50 65-75 50-60
Corn	before throwing out the panicle after throwing out the panicle	40-50 60-75
Beet	rooting leaf development root formation	30-40 40-50 55-60
Cabbage, onions, cucumbers	rooting maximum development	20-30 30-50
Potatoes, tomatoes	rooting maximum development	30-40 45-60
Gardens and vineyards	during the growing season	70-130

A review of research in the republic shows that drip irrigation saves water by 34-50% compared to furrow irrigation, subsoil irrigation - by 30%, and the increase in cotton yield, respectively: 0.3-1.1; 20-25%; 10-20%; 10%; 1.1 t/ha. These data were obtained from experimental plots.

As is known, currently in Central Asia, the cheapest, simplest and most reliable method of surface irrigation has become most widespread: furrow irrigation of industrial, row crops, winter grain crops and crop rotation crops is carried out on 72% of the territory of irrigated agriculture. There is a reason for this - the adaptation of the irrigation method to any natural and economic conditions, the relative simplicity of organizing irrigation based on the experience of previous generations, the lack of special qualifications of irrigation operators in traditional farming farms, from where the process of migration replenishment of the contingent of irrigation residents on newly developed lands usually takes place. Therefore, the improvement of furrow irrigation was and is the most attractive for the development of various proposals for improving the methods and techniques of furrow irrigation.

This issue has become especially relevant in the context of the restructuring of existing farms, the increasing role of market relations, in the creation of farms that pose problems to the water users association regarding the urgent tasks of solving emerging problems of water distribution on traditional irrigated and newly developed lands. Thus, in terms of irrigation technology, trends have emerged in the direction of research to create a concept of water saving when irrigating in furrows:

– development of theoretical and practical implementation of optimization of the values of elements of furrow irrigation technology;

- improvement of outdated furrow designs and cutting them in different directions along the slope;

– minimizing soil tillage and soil protection measures;

– on amelioratively disadvantaged lands and in conditions of emerging difficulties in developing and irrigating lands in the Adyr zone, it is necessary to use the biological properties of drought, salt and wilt resistance of new varieties of cotton, corn and search for an optimal irrigation regime for them for various natural, economic and climatic conditions of the republic;

- widespread use of various mulching materials in the form of polyethylene film, polymers for water conservation, soil protection from erosion when irrigating along furrows;

– creation of lightweight portable irrigation means for irrigation along furrows on large and steep slopes: corrugated, polyethylene pipes, hoses, portable trays, i.e. equipping farmers with small-scale mechanization and irrigation automation.

4 Conclusions

– Improving the ameliorative condition of lands in the cotton growing zone by carrying out desalinizing measures with chemical ameliorants in the soil and cultivating cotton under a film under the studied irrigation regime with pre-irrigation soil moisture of 70-70-65% of the soil NV.

– Methods of supplying water to the field were studied in the following variants: conventional watering and cultivating cotton under a film at an irrigation rate based on moisture deficiency in the soil, reducing it by 25% and increasing it by 50% with the addition of a desolenizer from the Swiss company Sibo Sper Sal for desalination of the top layer soil at a recommended dose of 5 l/ha when mixed with water.

– A preliminary study of the desalinating effect of Sper Sal at doses of 3 l/ha, 5 l/ha, 7 l/ha together with water in a ratio of 1:10 showed a more desalinating effect at 5-7 l/ha. At the same time, the irrigation technique was studied at a rate of 1200-1210 m^3/ha net.

– Determination of the hypothetical removal of salts in the soil showed their migration: according to $Ca(HCO_3)_2$ - 0.7-9.4 t/ha; CaSO4 – 29.4-36 t/ha; $MgSO_4$ – 6.8-7.3 t/ha; Na_2SO_4 – 74-110 t/ha and NaCl – 40-44.6 t/ha, and control irrigation without the drug Sper Sal at higher irrigation rates, respectively: 2 t/ha; 23.7 t/ha; 5.8 t/ha; 23 t/ha; 23.2 t/ha.

– The dynamics of the salt balance in the experimental variants shows the horizontal migration of salts towards the row spacing and the desalinization of the soil on the ridge and at the bottom of the furrow.

– To carry out irrigation technology during measures for the desalinizing effect of Sper Sal, cultivating cotton under film at irrigation rates based on moisture deficiency in the soil, when it is reduced by 25%, taking into account low-water years and limited water supply to farms, and when it is increased by 50%, elements of irrigation technology have been determined: flow rate, irrigation time, furrow length with minimal water losses for filtration and discharge from the field, i.e. with an increase in the efficiency of irrigation technology to 0.83-0.91.

– Irrigation water savings ranged from 32 to 762 m^3/ha, from 391 to 1391 m^3/ha and from 430 to 1360 m^3/ha according to the options.

– The highest cotton biomass of 239.8-262.4 g/plant was observed in the variants with an increased rate of irrigation under the film.

– The highest yields of raw cotton in all years were observed in variants with increased irrigation rates and when cultivating cotton under film with and without Sper Sal - 40.2-45.4 c/ha, in the control - 27.8-31.5 c/ha.

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