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The Effect of Water-Saving Technologies on the Growth and Productivity of Rice in the Soil Climate of the Republic of Karakalpakstan

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Abstract: ***Based on the results of the research, the use of drip irrigation technologies in rice cultivation is based on the optimum irrigation regimes in accordance with the soil and climate conditions of the region, the mechanical composition of the soil, the level of salinity, the mineralization of the collector water, the effect on the growth and productivity of rice, the cultivation of rice using water-saving technologies in experimental options field and laboratory researches were carried out.***
Keywords: Soil, water, rice, technology, rain, drip, irrigation, rate, mode, economy, seepage waters, mineralization, balance, salinity.

I. INTRODUCTION

In the soil and climate conditions of the Republic of Karakalpakstan, many scientific research works have been carried out on improving irrigation techniques and technologies of agricultural crops, mainly cotton. However, fundamental, practical and innovative projects for the development of water-saving technologies in rice cultivation in conditions of water scarcity have not been implemented. As a result of the global climate change observed in recent years, in the conditions of frequent water shortages in our region, especially in our republic, the areas where rice is grown are shrinking. In most cases, the fact that water-saving irrigation technologies have not been tested in practice or the lack of scientifically based recommendations on the irrigation regime is an obstacle to the introduction of water-saving irrigation technologies in rice cultivation in practice. Today, most of the zoned rice varieties cultivated in large areas of our republic are considered very demanding on water and have high productivity compared to flooding in dry conditions. Therefore, it is very important to test effective water-saving irrigation technologies that can save water in rice cultivation, which is relatively water-intensive among agricultural crops. Materials and methods: "Guliston" variety of rice was selected for the field research-experimental work on the implementation of water-saving irrigation technologies in rice cultivation, and an experimental area of the Scientific Production Association of Grain and Rice (IIChB) was established in the Nukus district of the Republic of Karakalpakstan. Research In field experiments, phenological observations and biometric measurements of rice growth and development, phenological, soil and plant sample analyzes were carried out in accordance with the requirements of GOST 32-2001 and "Methodological instructions for growing rice in Uzbekistan". Statistical analysis of data on rice productivity was carried out based on the methodology of B.A. Dospehov "Metodika polevogo opyta" (1979; 1985) and "Methodological manuals for field and laboratory experiments" required by the recommendations established in the Republic of Uzbekistan. , salinity, mineralization level, water-salt balance indicators were determined.

II. RESULTS AND DISCUSSIONS

Field experiments were conducted in the fields of the Scientific Association of Grain and Rice Production located in the Nukus district of the Republic of Karakalpakstan. The area of sprinkler and drip irrigation system designed and built in each research facility is 1.5 ha. The experimental system consisted of 5 options, soils with moderate salinity, placed in 1 replication, 1 tier.

Table 1 Experience system

Opt №	Rice varieties	Irrigation method	Daily estimated irrigation rate, (m3/ha)	Irrigation (interval) duration, (days)
Rice Scientific Processing Unit in Nukus District in the Republic of Karakalpakstan (Experiment 1)				

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1	Guliston	Conventional Flood Irrigation (Control Option)		
2		Drip irrigation	175	1
3		Sprinkler irrigation	180	2
4		Drip irrigation	110	1
5		Sprinkler irrigation	125	2

In the Republic of Karakalpakstan, the soil of the 1st experimental field in the Nukus district of the Scientific Processing Unit of Grain and Rice is located, the mechanical composition of the soil is medium and heavy loam, the underground water is located at 2-3 m, and it has been irrigated for a long time.

Agrochemical properties of experimental field soil

It is important to determine the potential fertility of the soil and feed it with mineral fertilizers in the process of testing resource-efficient irrigation technologies for growing rice and obtaining a higher and better quality harvest. During the research, observations and analyzes were carried out in order to determine the level of nutrient supply of the soil of the experimental areas during the pressure and drip irrigation of the selected varieties of rice. In the researches, at the beginning of the growing season, the amount of humus in the plowed 0-10 cm layer of the soil at the beginning of the growing season was 0.73 percent, 0.70 percent in the 10-20 cm layer, and 0.91 percent in the 20-30 cm layer. was 0.19-0.17 percent, respectively. Also, the amount of dry residue was 1.515 percent in the 0-10 cm layer, 1.559 percent in the 10-20 cm layer, and 0.771 percent in the 20-30 cm layer, and the amount of total salts was 1.431-1.472-0.725 percent, respectively. In addition, the amount of phosphorus and potassium in the soil is 146.0-234.0 mg/kg in the 0-10 cm layer, 135.0-120.9 mg/kg in the 10-20 cm layer, and 135 in the 20-30 cm soil layer. was 0-134.6 mg/kg.

Salinity level of experimental field soils

The total irrigated land area of Nukus district is 30,745 ha, of which the area provided with internal collector-drainage networks is 25,954 ha. According to the data of the Meliorativ Expedition of the Ministry of Water Resources of the Republic of Karakalpakstan every autumn, 37.49 percent of the areas were not saline in 2020. , 25.85 percent of the area is low salinity land, 36.67 percent is medium and high salinity area.In 2021, 37.56 percent of irrigated land is non-saline, more than 25.89 percent is low salinity, and 36.55 percent is medium and strong salinity. It can be seen that the level of soil salinity has been decreasing year by year (Table 1).

Table 2 Data on salinity levels of irrigated lands in Nukus district during the growing season

Years	Total irrigated area, thousand ha	including							
		unsalted		desalted		moderately salty		strongly salted	
		field	%	field	%	field	%	field	%
2020	30,80	11,547	37,49	7,961	25,85	11,047	35,87	0,246	0,80
2021	30,74	11,547	37,56	7,961	25,89	10,991	35,75	0,246	0,80

Seepage water level and mineralization

In order to compile the general water-salt balance of the irrigated lands in the area where the researches were conducted, mainly during the years 2020-2021, according to the data of the Meliorativ Expedition, when analyzing the depth of the seepage waters of Nukus district, the level of seepage waters decreased during the fall of 2020-2021 (Table 2).

Table 3 Depth of seepage water in irrigated fields in Nukus district during the vegetation period, m

Months	Years	Irrigated area, thousand, ha	Seepage water level in the field, m									
			0-1 m		1-1,5 m		1,5-2 m		2-3 m		3-5 m	
			thousand, ha	%	thousand, ha	%	thousand, ha	%	thousand, ha	%	thousand, ha	%
April	2020	30,80	0,81	2,63	2,64	8,57	18,31	59,45	7,33	23,80	1,71	5,55
	2021	30,80	0,67	2,18	2,3	7,47	19,89	64,58	6,19	20,10	1,75	5,68
July	2020	30,80	7,55	24,51	6,8	22,08	15,13	49,12	0,8	2,60	0,52	1,69
	2021	30,80	1,58	5,13	1,67	5,42	17,06	55,39	9,75	31,66	0,74	2,40
October	2020	30,80	0,55	1,79	5,57	18,08	20,72	67,27	3,05	9,90	0,91	2,95
	2021	30,80	0,95	3,08	1,24	4,03	22,67	73,60	4,25	13,80	1,69	5,49

Table 4 The norms of seasonal water consumption according to variants of the "Guliston" rice variety planted in the Scientific Processing Unit experimental field of grain and rice in the Nukus district of the Republic of Karakalpakstan

options, №	Rice varieties	Vegetation period of rice varieties, days	Irrigation methods	Pre-sowing flood irrigation rate, m^3/ha	One-time irrigation rate, m^3/ha	One-time irrigation rate, average (m^3/ha)	Seasonal irrigation rate, m^3/ha	Biological productivity of rice, c/ha	Water consumption for growing 1 c of fruit, m^3/c
1	2	3	4	7	8	9	10	11	12
1	Guliston	90-95	Conventional Flood Irrigation (Control Option)	2265	1500-2000	1300	20465	47,9	427
2			Drip irrigation		120-244	224	12776	35,0	365
3			Sprinkler irrigation		125-255	231	13111	36,1	363

4			Drip irrigation		110-152	139	15062	43,0	351
5			Sprinkler irrigation		130-164	152	16204	43,4	373

In the experimental area where water-saving irrigation technologies were introduced, the "Guliston" variety of rice was planted, and in the 1st option of rice irrigation research, i.e., in the control options with traditional forced irrigation, the seasonal water consumption rate of rice was 20465 m3/ha. According to the results of the 2nd variant of the research, the seasonal water consumption norms of drip-irrigated rice are 12766 m3/ha, the norm of one-time drip irrigation is 120-244 m3/ha, the number of irrigations by drip irrigation technology is 47 times, 37 per season compared to the control option of pressure irrigation 6 percent irrigation water saved. According to the results of the 4th variant of the study, the seasonal water consumption rate of drip-irrigated rice is 15062 m3/ha, the rate of one-time drip irrigation is 110-152 m3/ha, the number of drip irrigations is 92 times, compared to the control option with pressure irrigation, 26.4 per season. percent irrigation water saved.

Furthermore, according to the results of the 3rd variant of rain irrigation research in the first pilot field where water-saving irrigation technologies were introduced, the seasonal water consumption rate of rain-irrigated rice is 13111 m3/ha, the rate of one-time rain irrigation is 125-255 m3/ha, the number of rain irrigations and 35.9 percent of irrigation water was saved compared to the control option that was irrigated 47 times. According to the results of the 5th variant of the research, the seasonal water consumption rate of rice is 16204 m3/ha, the rate of one-time sprinkler irrigation is 130-164 m3/ha, the number of sprinkler irrigations is 92 times, and 20.8 percent of irrigation water is saved in the season compared to the control option with forced irrigation has been achieved.

Table 5 Results of phenological observations on the growth and development phases of rice grown in the experimental area

№	Planting period	Follow-up periods												Number of plants per 1 m^2 (at the beginning of vegetation)	Number of plants per 1 m2 (at the ending of vegetation)
		Germination		A pile up		Stem		Crop		Flowering	Ripening				
		The beginning	Full germination	The beginning	Full coverage	The beginning	Complete stem	Panicle initiation	Heading		Milk stage	Dough stage	Mature		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Traditional method of watering rice (option 1)															
1	23.05	31.05	02.06	20.06	24.06	09.08	13.07	29.07	01.08	06.08	10.08	19.08	03.08	160	150

Drip irrigation of rice (option 2)															
2	23.05	31.5	02.06	21.06	25.06	08.07	10.07	27.07	30.07	04.08	09.08	16.08	02.09	157	136
Sprinkle irrigation of rice (option 3)															
3	23.05	31.05	02.06	21.06	25.06	07.07	09.07	25.07	28.07	02.08	06.08	15.08	31.08	161	144
Drip irrigation of rice (option 4)															
4	23 05	31.05	02.06	20.06	24.06	09.07	11.07	27.07	30.07	04.08	08.08	16.08	01.09	157	138
Sprinkle irrigation of rice (option 5)															
5	23.05	31.05	02.06	20.06	24.06	07.07	09.07	25.07	28.07	02.08	06.08	14.08	30.08	163	145

Table 6 Indicators of grain yield of rice grown in the experimental area

№	Number of plants in per 1m ^{2}, unit/m^2	Maximum tiller numbers per 1 m^2, unit/m^2	Number of productive tillers in per 1 m^2, unit/m^2	Number of grains of rice in one heae, unit	Height of rice stem, sm	weight of strings of stems in 1m^2, g	Weight of grains of rice in one head, g	Length of head, sm	weight of 1000 grains of rice, g	Biological productivity of rice, c/ha
1	2	3	4	5	6	7	8	9	10	11
Traditional method of watering rice (option 1)										
1	150	205	201	130	88	496	4,46	18	26,0	47,9
Drip irrigation of rice (option 2)										
2	136	160	154	79	68	348	2,34	13	27,65	35,0
Sprinkle irrigation of rice (option 3)										
3	144	183	178	83	72	365	2,41	14	29,2	36,1
Drip irrigation of rice (option 4)										
4	138	171	165	81	70	356	2,38	13	27,28	43,0
Sprinkle irrigation of rice (option 5)										
5	145	190	184	85	73	371	2,60	15	29,8	43,3

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III. CONCLUSIONS

Field research was conducted on the basis of sprinkler and drip irrigation technology of rice variety "Guliston" in the first experimental field of the experimental station of the Grain and Rice IIChB in the Nukus district of the Republic of Karakalpakstan on the introduction of water-saving irrigation technologies in rice cultivation. The experimental system was carried out in 3 variants, variant 1 is the control variant, i.e. traditional pressure irrigation, variant 2 is drip irrigation (every other day irrigation), variant 3 is drip irrigation (daily irrigation).

During the researches, the control option, which used the traditional flood irrigation method of rice, i.e., in options 1, the rate of one-time flood irrigation during the growing season was on average 1300 m3/ha, and the seasonal irrigation rate was 20465 m3/ha.

In options 2, where rice is drip-irrigated every other day, the rate of one-time drip irrigation is 120-244 m3/ha, the rate of seasonal irrigation is 12776 m3/ha, in option 3, in options where rice is drip-irrigated daily, the rate of one-time drip irrigation is 110-152 m3/ha and the seasonal irrigation rate was 15062 m3/ha.

According to the results of the experiment, the amount of water used for the cultivation of 1 ts of rice crop was observed a big difference according to the options. In this case, 427 m3 of water was used for the cultivation of 1 t of rice crop in the conventional methods of pressure irrigation, while it was 351-365 m3 in the drip irrigation.

According to the results of the observation on the yield of cultivated rice, the rice yield was 47.9 t/ha in the control options irrigated by the traditional method, and 35.0-43.0 t/ha in the drip irrigation options.

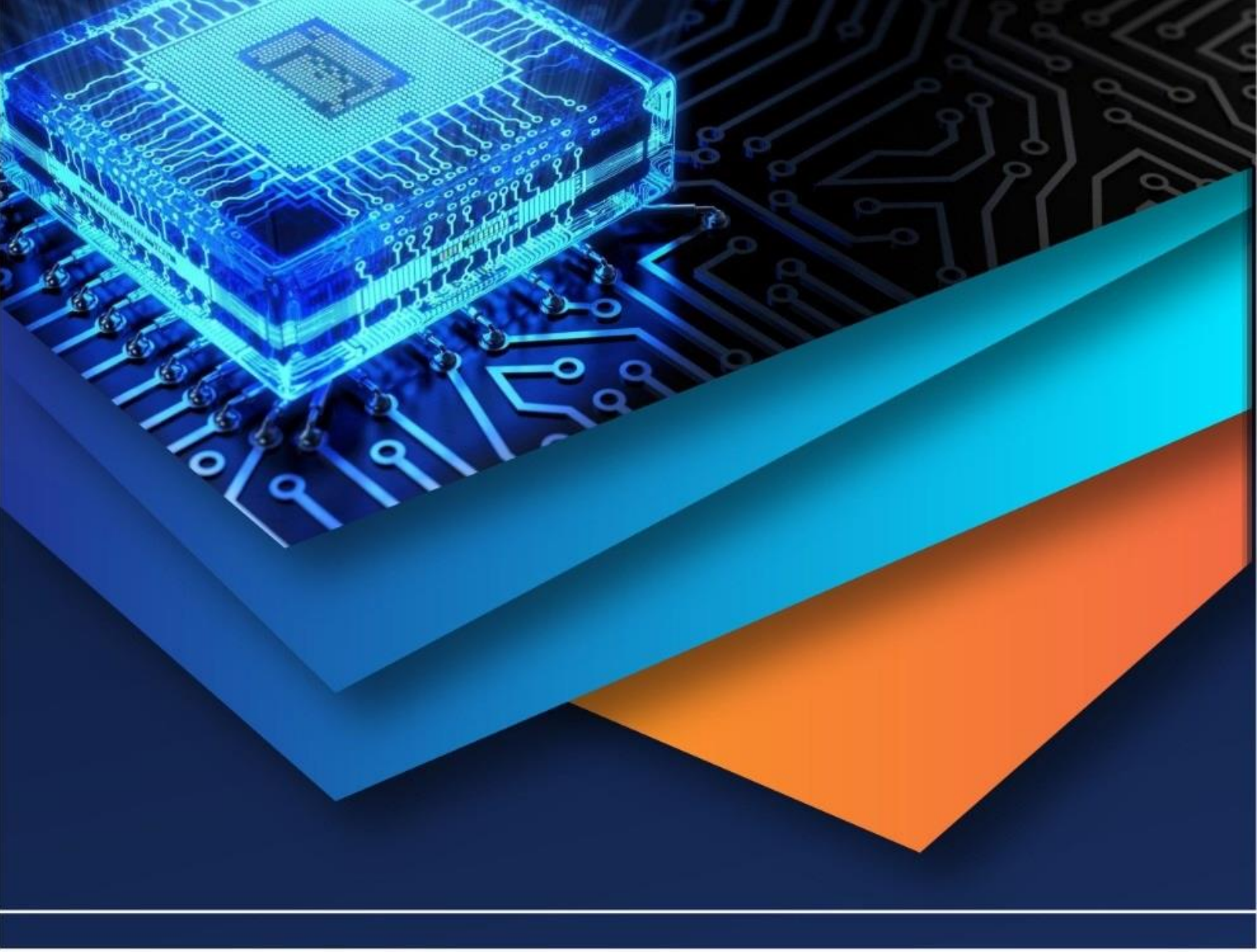
26.4-37.6 percent water savings have been achieved in drip irrigation options compared to traditional flood irrigation options.

Based on the results obtained in the first year of the conducted researches, it was observed that the water saving rate was higher and the yield rate was decreased in the options where drip and rain irrigation technologies were introduced compared to the traditional flood irrigation method.

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