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Application of Water-Saving Technologies in the Growing of Rice in the Soil Climate Conditions of the Republic of Karakalpakstan

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Abstract: Based on the results of the research, based on the optimal irrigation regimes for the soil and climatic conditions of the region, determining the use of drip irrigation technologies in rice cultivation, field and laboratory studies were carried out on the mechanical composition of the soil, the level of salinity, the mineralization of collector and reservoir waters, and the experimental options for the cultivation of rice using water-saving technologies.

Keywords: Soil, water, rice, technology, sprinkler irrigation, rate, regime, economy, groundwater, mineralization, balance, salinity.

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 introduction of water-saving irrigation technologies in rice cultivation, and experimental area of Grain and Rice Scientific Production Association of Nukus District was established in the Republic of Karakalpakstan.

In this case, the area of the sprinkler irrigation system designed and built in each research facility is 1.5 ha. The experimental system consisted of 3 options, the soils of which were moderately salinized, and were placed in 1 replication, 1 layer. In the design of the sprinkler irrigation system, a sprinkler irrigation system was used, in which each sprinkler device was placed at an interval of 12x12 m.

Researches were carried out based on the "Methodological manuals for conducting field and laboratory experiments" required by the recommendations established in the Republic of Uzbekistan, and the mechanical composition of the soil, salinity, mineralization level, water-salt balance indicators were determined in the laboratory.

Results and discussions: "Guliston" variety of rice was planted in the experimental area where water-saving irrigation technologies were introduced, and in the 1st option of rice irrigation research, i.e., in the traditional forced irrigation option, the seasonal water consumption rate of rice is 20465 m3/ha. in the 2nd variant of the research, 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, and the number of rain irrigations is 47 times, and 35.9% of irrigation water is saved compared to the control option with forced irrigation. . In the 3rd variant of the study, the standard of seasonal water consumption of rice is 16204 m3/ha, the standard 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 saving was achieved in the season compared to the control option of forced irrigation.

Agrochemical properties of experimental field soil

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 suppression and rain 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

According to the information of the soil salinity sample checked by the Reclamation Expedition of the Ministry of Water Economy of the Republic of Karakalpakstan every autumn, in 2020, 37.49 percent of the areas were not saline, 25.85 percent were low salinity, and 36.67 percent were areas with medium and strong salinity . 37.56 of irrigated land in 2021 percent are non-saline areas, more than 25.89 percent are low salinity lands, 36.55 percent are medium and strong salinity areas. It can be seen that the salinity level of the soil decreased by a small amount from year to year (Table 1).

Table 1. Data on salinity levels of irrigated lands during the growing season

Years	Total irrigated area , thousand ha	Including							
		Unsalted		low salted		average salted		strong salted	
		Square	%	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

Groundwater level and salinity

In order to establish the general water-salt balance of the irrigated lands in the section of the researched areas, mainly during the years 2020-2021, according to the data of the Meliorativ expedition, when analyzing the depth of the seepage waters of the Nukus district, the level of underground water decreased during the fall of 2020-2021 (Table 2).

Table 2. The depth of underground water in the irrigated fields in the experimental area during the vegetation period, m

Months	Years	Irrigated area , thousand , ha	Groundwater level, 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 3. Seasonal water consumption norms for variants of "Gulistan" rice variety planted in the experimental field

Options, no	Rice varieties	Vegetation period of rice varieties, days	Watering methods	Rate of pre-sowing irrigation, m^3/ha	One-time irrigation rate, m^3/ha	One-time irrigation rate, average (m^3/ha)	Seasonal irrigation rate, m^3/ha	Cultivated crop, ts/ha	Water consumption for growing 1 ts of fruit, m^3/ts
1	**2**	**3**	**4**	**7**	**8**	**9**	**10**	**11**	**12**
1	Gulistan	90-95	Conventional Flood Irrigation (Control Option)	2265	1500-2000	1300	20465	47.9	427
2			Sprinkler irrigation		125-255	231	13111	36.1	363
3			Sprinkler irrigation		130-164	152	16204	43.4	373

Based on the results obtained during the experiments, it was observed that the efficiency of water use increases when water-saving irrigation technologies are introduced in rice cultivation. In the 2nd variant, the "Guliston" variety of rice planted in the experimental area was irrigated by rain irrigation technology, the amount of water used to grow 1 t of rice was 363 m^3/t, in the 3rd option, the amount of water used to grow 1 t of rice was 373 m^3/t formed

Conclusions

Field researches were carried out on the basis of rain and drip irrigation technology of "Guliston" rice variety in the experimental area of the Scientific Association of Grain and Rice Production in Nukus district in the Republic of Karakalpakstan on the introduction of water-saving irrigation technologies in rice cultivation. The experimental system was carried out in 3 options, the 1st option is the control option, i.e., traditional pressure irrigation, the 2nd option is sprinkler irrigation (every other day), and the 3rd option is sprinkler irrigation (daily irrigation).

During the researches, in the control option, which used the traditional flood irrigation method of rice, i.e., in the 1st variant, the rate of one-time flood irrigation during the growing season was on average 1300 m^3/ha, and the seasonal irrigation rate was 20465 m^3/ha.

In the 2nd option of irrigating rice with intermittent rain, in the options of irrigating rice with intermittent rain, the standard of one-time irrigation is 125-255 m^3/ha, the standard of seasonal irrigation is 13111 m^3/ha, in the 3rd option of daily irrigation, the standard of one-time irrigation is 130-164 m^3/ha, seasonal irrigation rate was 16204 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 in the conventional irrigation options, while in the sprinkler irrigation options, this figure was 363-373 m3.

According to the results of the observation on the yield of cultivated rice, the rice yield was 47.9 t/ha in the control variants irrigated by the traditional method, and 36.1-43.4 t/ha in the sprinkler irrigation options.

As a result of studies, 20.8-35.9 percent water savings were achieved in sprinkler irrigation options compared to conventional irrigation options.

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