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Investigation of tolerance of sorghum crop to water deficit conditions during drip irrigation

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Abstract: In the article, the sorghum plant was irrigated using modern irrigation technologies and the irrigation period of the plant as a result of drip irrigation was studied. In the article, the soil moisture determination in the research area, the information of the area for planting sorghum was studied. Phenological observations were made and the results were analyzed. The resistance of the sorghum crop to water shortage conditions during the period of drip irrigation was checked. During the research, land reclamation conditions were studied, seed planting plans were made based on the data for plant growth. Monitoring wells were dug to monitor the level of underground water and permanent monitoring was established. Based on the results of drip irrigation, the yield of the crop was determined, according to which the average weight of a head was 0.10 kg, and the average weight of 30 heads was 3.1 kg. "Using water-saving technologies" of the "Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" National Research University scientific training center located in Ortachirchik district of Tashkent region in 2022 in order to check the resistance of agricultural crops to water shortage conditions during the irrigation period prepared based on the results of scientific research carried out at the landfill.

Keywords: Sorghum, drip irrigation, productivity, water-saving technologies, phenological monitoring, agrotechnical measures, soil moisture

Introduction: The situation with water shortage in our region is getting more complicated year by year. In the last 10 years, for example, the volume of water in Uzbekistan has decreased by 12%, compared to last year, this year by 15%. Conditions have been created for the introduction of water-saving technologies and the use of water-saving technologies for various plants in our republic. There are many examples of reforms being carried out in this regard. The principle schemes of using irrigation methods with closed use of water in the field have been developed, which reduce or exclude negative processes: water leakage outside the field in conditions of subsidence, subsidence, soil erosion and losses in filtration in the soil allows to do; allows to save water up to 30-48% compared to conventional irrigation [1].

Mulching technology is not a new technique in the world. However, its application in different fields has shown different effectiveness. Nevertheless, the technique is very useful for countries like Uzbekistan. Experiments conducted here have shown promising results in drought harvesting. However, the analysis must be conducted in a highly controlled environment in order to scientifically present the adjusted conclusions. Therefore, the research should be carried out in the identified area for a longer period of time. In addition, it is necessary to analyze the accuracy of water saving efficiency [2].

We emphasize that the effects of economic recovery in Uzbekistan may occur in the near future due to the following reasons:

1. current shortage of irrigation water;
2. expansion of irrigated lands;
3. switch to crops that require less water;
4. GDP growth

The results of the study are of important political importance, because the government of Uzbekistan has implemented water-saving irrigation technologies on more than 2 million hectares of irrigated land (about 50 percent of the total irrigated land) to increase the irrigation efficiency from 0.63 to 0.73. expanding the installer. In the strategy of water resources development in 2020-2030. However, the document did not

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specify how these numbers were determined. Today, smart water measuring equipment is being installed in all regions to accurately determine the amount of underground water [3].

The water permeability of the soil was 1207-1260 m3/ha in options 2 and 6, and 1249-1405 m3/ha in options 3 and 7, where black plastic film was irrigated with a furrow and. 1284 was 1290 m3/ha. options 4 and 8 were used for furrow irrigation from the opposite side. The rate of water absorption into the soil is 0.78-0.87 mm/min in the first hour, and 0.10-0.12 mm/min in the sixth hour. [4]. Today, monitoring of plants is carried out using modern technologies. ArGIS, ENVI, and other satellite image programs can be used to remotely identify and monitor plant growth. [5].

In the first year after the introduction of the drip irrigation system, the new material did not increase the productivity of the forage cactus. Irrigation depths (25, 50, 75 and 100% ET0) and cross-forage cactus-sorghum system produced benefits from the second year of introduction. Sorghum monoculture and intercropping systems had the best yield performance when irrigated with at least 50% ET0. The average values of effective operating costs contributed the most to the formation of total costs (91.9%), of which 83.60% came from the costs of the irrigation system (suction, discharge and motor pumps). Lessons learned allow you to get more accurate information by repeating the research several times in a row. [6–10].

Water use in agriculture is a key link between the natural environment and the socio-economic system. It is important to study the vulnerability of agricultural water resources to ensure the sustainability of water resources and to mitigate the risks of floods and droughts. In order to study the changing characteristics of agricultural water resource vulnerability in Central Asia, an index system consisting of 18 indicators consisting of three components - exposure, sensitivity and adaptation - was created according to the vulnerability assessment scheme. [11,12].

The use of GIS technologies in the process of conducting phenological observations in field research facilitates experimental work. We enrich the experimental analysis by monitoring the growth of plants, and performing analysis of the previous and subsequent condition [13,14].

Materials and methods.

20 drip hoses 50 m long were installed in the experimental field at a depth of 30 cm at an interval of 1.2 m. Sorghum was planted 15 cm apart on either side of the line where the drip hoses were located. a total amount of 1.8 kg of sorghum seeds was dripped from 1.2 ha of soil into the irrigation field for the experiment. A total of MTZ 80 tractors spent 3 hours, and a total of 4 people worked for 80 hours during agrotechnical activities. The vegetation period lasted 145 days, and during this period soil moisture, seepage water level and irrigation water volume were regularly controlled. Mineral and organic fertilizers were not used during the vegetation period.

Using modern water saving technologies, drip irrigation technology was selected for our field research. In drip irrigation, the types of hoses that deliver water to the plants in convenient conditions at the required level were selected.

Sana 21.08.2022y		
Sorga (27 qator)	o`simligi qator orasiga yotqizilgan tomchilatish shlang turi	
Ko`p yillik shlang	27 qator	20 qatori tomizgich orasi 20 sm, 7 qatori tomizgich orasi 50 sm
Bir yillik shlang	mavjud emas	
Oq jo`xori (27 qator)	o`simligi qator orasiga yotqizilgan tomchilatish shlang turi	
Ko`p yillik shlang	27 qator	20 qatori tomizgich orasi 20 sm, 7 qatori tomizgich orasi 50 sm
Bir yillik shlang	mavjud emas	
Amaranta (23 qator)	o`simligi qator orasiga yotqizilgan tomchilatish shlang turi	
Ko`p yillik shlang	22 qator	4 qatori tomizgich orasi 20 sm, 18 qatori tomizgich orasi 50 sm
Bir yillik shlang	1 qator	tomizgich orasi 20 sm
Sorga +Oq jo`xori (18 qator)	o`simligi qator orasiga yotqizilgan tomchilatish shlang turi	
Ko`p yillik shlang	mavjud emas	
Bir yillik shlang	18 qator	tomizgich orasi 30 sm

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During the vegetation period, soil moisture was regularly sampled and monitored. Irrigation works were organized based on the results of humidity. A soil layer with a moisture content of up to 225 cm depth was sampled three times from one place. Soil moisture was taken 15 times during the general vegetation period.

1-rasm

1- picture: Taking samples to measure soil moisture

Results and their discussion: During the vegetation period, soil moisture was regularly sampled and monitored. Irrigation works were organized based on the results of humidity. A soil layer with a moisture content of up to 225 cm depth was sampled three times from one place. Soil moisture was taken 15 times during the general vegetation period.

2- picture

2- picture: Drying soil in a special oven

Results from the first point

1- table

04.08.2022y Tuproq namligini aniqlash uchun olingan namunalar 1 nuqta				
№	**Buyuksa nomeri**	**Buyuksa og‘irligi**	**Nam tuproq ogirligi**	**quritilgan tuproq og‘irligi**
1	.007	22.83	47,27	46,68
2	106	22,15	48,03	47,16
3	.002	22,21	48,51	47,27
4	.039	22,55	45,76	44,65
5	196	21,96	48,88	47,17
6	114	21,8	47,61	45,99
7	101	22,59	51,73	50,05
8	.081	22,44	49,02	47,49
9	.080	21,83	49,64	48,05

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Jami	177,53	389,18	377,83

Ikkinchi nuqtadan olingan natijalar

2-jadval

Tuproq namligini aniqlash uchun olingan namunalar 2 nuqta				
№	**Buyuksa nomeri**	**Buyuksa og‘irligi**	**Nam tuproq ogirligi**	**quritilgan tuproq og‘irligi**
1	345	22,89	47,1	46,73
2	.004	22,19	46,99	45,47
3	.044	22,22	46,56	44,56
4	.015	22,92	48,14	46,36
5	.085	21,45	43,08	41,75
6	.099	21,58	48,62	46,47
7	163	22,8	46,49	44,62
8	193	20,42	45,18	43,2
9	279	21,99	47,48	45,44
Jami		175,57	372,54	357,87

Uchinchi nuqtadan olingan natijalar

3-jadval

Tuproq namligini aniqlash uchun olingan namunalar 3 nuqta				
№	**Buyuksa nomeri**	**Buyuksa og‘irligi**	**Nam tuproq ogirligi**	**quritilgan tuproq og‘irligi**
1	61	21,71	40,29	39,38
2	7	24,52	51,25	49,92
3	302	22,94	48,23	46,85
4	10	20,9	47,2	45,83
5	214	23,58	44,95	44
6	1	22	46,46	44,94
7	67	22,09	45,84	44,57
8	161	22,14	48,31	47,06
9	42	21,58	46,12	45,05
Jami		179,75	378,36	368,22

Along with moisture measurement, we also measured water consumption during drip irrigation of sorghum and amaranth crops. In the process of measuring water consumption, water consumption coming out of drip irrigation hoses from 8-10 points of the crop area was measured. is measured and averaged.

4- table

№	**Suv berish sanasi**	**Suv berish soati**	**1 min.da tomizg`ichdan tomgan suv miqdori, gr**	**1 min. da o`rtacha tomgan suv miqdori, gr**	**1 qatordagi tomizg`ichlar soni, dona**	**Umumiy qatorlar soni, dona**	**Maydonning suv iste'moli, ltr.**	**Maydonning suv iste`moli, m kub**
1	28.06.2022	2	24,18					
		2	14,9	18,74	250	97	54533,4	54,53

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		2	17,14					
2	07.07.2022	2	20,68					
		2	14,74	15,92	250	97	46327,2	46,33
		2	12,34					
3	11.07.2022	2	18,01					
		2	9,86	14,94	250	97	43475,4	43,48
		2	16,96					
4	15.07.2022	3	8,62					
		3	11,25	11,43	250	97	49891,95	49,89
		3	14,42					
5	20.07.2022	3	9,36					
		3	17,75	12,05	250	97	52598,25	52,6
		3	9,04					
6	27.07.2022	3	19,09					
		3	21,35	19,91	250	67	60028,65	60,03
		3	19,3					
7	01.08.2022	2	16,46					
		2	18,88	18,34	250	67	36863,4	36,86
		2	19,7					
8	04.08.2022	3	10,3					
		3	13,7	13,17	250	67	39707,55	39,71
		3	15,52					
9	08.08.2022	2	18,03					
		2	20,48	18,57	250	67	37325,7	37,33
		2	17,2					
10								

The phenology of the sorghum plant during germination, that is, the height of the plant, the number of leaves, the length of the crop, and its weight, were studied. 40% of the total length of the sorghum plant, i.e. 55 cm long leaves were taken from the ground. The weight of the obtained leaves was measured, the measured time was recorded and they were spread on the ground for drying. More observations were made during crop yielding. The productivity of the field area was calculated in the early, middle and last winters and the results were presented in a tabular form.

Sorga o`simligining hosildorligi						
Qator №	**O`rtacha 30 Bosh og`irligi, kg**	**O`rtacha Bosh og`irligi, kg**	**O`rtacha 30 Don og`irligi, kg**	**O`rtacha don og`irligi, kg**	**Qatordagi boshlar soni, dona**	**Qatordagi Hosil, kg**
1	2,0	**0,07**	1,6	0,05	87	4,64
2	1,8	**0,06**	1,55	0,05	214	11,06
3	1,6	**0,05**	1,4	0,05	115	5,37
4	1,7	**0,06**	1,35	0,05	178	8,01
5	2,6	**0,09**	2,36	0,08	173	13,61
6	3	**0,10**	2,69	0,09	186	16,68
7	3,1	**0,10**	2,78	0,09	136	12,60
8	3,3	**0,11**	2,93	0,10	157	15,33
9	3,2	**0,11**	2,88	0,10	143	13,73
Jami	22,3	**0,74**	19,54	0,65	1389	101,03
O`rtacha	2,48	**0,08**	2,17	0,07	154	11,23

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Necessary measures were developed mainly to protect the crop from the external environment. Mainly, measures were taken to protect the crop from birds, rodents, and caterpillars.

Summary

Drip irrigation technology was mainly used in our field experiments to realize the goal of growing sorghum using modern cost-effective technologies. Special attention should be paid to agrotechnical measures during planting. The phenological observations from planting to germination and ripening will make the results of the experiment more accurate. It was recommended to review the results of field studies with the help of new programs that can be studied with satellite images for more accurate study. Ekin moisture content before and after irrigation was continuously measured and monitored. Monitoring wells were dug to monitor the level of underground water and permanent monitoring was established. Based on the results of drip irrigation, the yield of the crop was determined, according to which the average weight of a head was 0.10 kg, and the average weight of 30 heads was 3.1 kg. Planting, monitoring its development, irrigation and phenological results showed that sorghum is resistant to drought.

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