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EFFICIENT USE OF WATER IN THE KHOREZM OASIS

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ANNOTATION
The article provides information on the efficient use of water resources for the development of cotton irrigation regime, as well as on the identification and implementation of water-saving irrigation technologies and efficient use. The determination of cotton irrigation regime was carried out on the basis of the field experience scheme. Moreover, information on the water productivity used to obtain the maximum yield of cotton is given and the water balance of the cotton field compiled.

KEYWORDS: water, resource, cotton, irrigation regime, irrigation technology, fields, experience, system, water productivity, water balance.

INTRODUCTION

The government of Uzbekistan is working to improve the system of water resources management, improve the technical condition of irrigation systems, and monitor the state of irrigated lands and their improvement. Currently, much attention is paid to the introduction of water-saving technologies, the diversification of agricultural products for the development of farms. As a result of these activities, 43,000 hectares of drift irrigation, 46.4 thousand hectares, planting areas under films, and 34.0 thousand hectares, are irrigated using mobile flexible pipes together with outflow furrows are introduced in our Republic. The ameliorative condition improved for 1 million 200 thousand hectares of irrigated land. 149.4 thousand hectares of strongly and moderately saline lands decreased, the level of groundwater decreased with an area of 302.9 thousand hectares. The water supply of 1 million 300 thousand hectares of irrigated land has improved, and because of the reclaimed land, the cotton yield per hectare increased by 0.3-0.4 tons and wheat 0.4-0.5 tons [1, 2].

Decree of the President of the Republic of Uzbekistan on the State Program for the Implementation of the Action Strategy for the five priority areas of development of the Republic of Uzbekistan in 2017-2021 in the Year of “Supporting Active Entrepreneurship, Innovative Ideas and Technologies” and the intensive development of agriculture, as well as special attention was given to the conservation of water resources, the introduction of water saving agricultural technologies in agriculture sector [1].

To improve the regulatory framework for the development of irrigation and the ameliorative state of irrigated land and the rational use of water resources, the Decree No. 3405 of November 27, 2017 was adopted by the President of the Republic of Uzbekistan on the state program of land irrigation water use, crop irrigation based on scientific procedures and the use of advanced irrigation technologies [2].

Currently, for the rational use of water resources in the region, in particular, for stable economic development are one of the key issues, the solution of scientifically-based irrigation regimes of major crops, as well as the definition of irrigation technology that allow efficient use and introduction of production.

With the foregoing, in order to establish the effective use of irrigation water on meadow-alluvial soils of the Khorezm region, in accordance with the mechanical composition, as light, medium and heavy loamy soils, the groundwater level was located at a depth of 1.0-2.0 m The science-based irrigation regime of cotton has been studied, water-saving irrigation technologies and its elements have been determined, as well as their impact on the growth, development, yield and quality of cotton fiber. Scientific and practical recommendations were developed on cotton irrigation regimes and water-saving technologies.

Field experiments were carried out in the following system to determine the scientifically based irrigation regime for cotton and its water-saving technologies (Table 1).

Table 1. Scheme of field experience to determine the mode of irrigation of cotton

Options	Pre-irrigation moisture capacity of the soil, compared with the MMC,%	Irrigationrates, m3 / ha
1	Productioncontrol	Byactualmeasurements
2	70-70-60	According to the deficit of moisture in the layer of 50-100-70 cm.
3	70-80-60*	According to the deficit of moisture in the layer of 50-100-70 cm.
4	70-80-60	According to the deficit of moisture in the layer of 50-100-70 cm. With a valueof 30%

Note: 70-80-60% Maximum field moisture capacity (MMC): 70% - it is necessary to adhere to compliance with the maximum field moisture capacity of soil moisture before flowering; 80% soil moisture flowering - fruit formation; 60% moisture content in the soil of cotton ripening.

All experiments, laboratory and phonological observations were carried out on the basis of methodologies developed by research institutes [3, 4].

At the experimental site, the repetition of options for experiments, four times. All replicates were located in one tier (Fig. 1). Irrigation and irrigation rates were determined depending on the maximum field capacity of the soil.

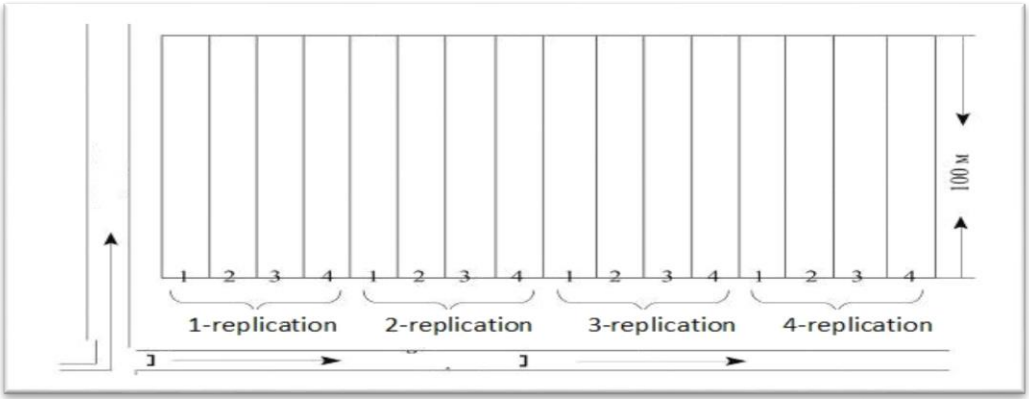

Figure 1.Scheme of the experimental plot.

Pre-field soil moisture regime is one of the key factors for obtaining a maximum and stable yield of agricultural crops, including cotton. To do this, it is necessary to manage all the factors in the soil that have great importance on the growth and development of cotton, like water-air-heat, etc. Taking this into account, good research results have been achieved by maintaining soil moisture. In practice, the actual soil moisture was ± 2.0% based on the results of the work performed. This proved that the studies were performed correctly. These irrigation regimes of cotton, depending on the dynamics of changes in soil moisture in the Khorezm region, are presented in Table 2 [5, 6, 7, 9].

The irrigation and irrigation rates in the experimental plot in the Khorezm region were determined using the aforementioned irrigation scheme (Table 2).

Table 2.The irrigation regime of cotton (in accordance with the average three-year observations)

ExperimentNo.	Options	Irrigationrates, m^3 / ha	Irrigationscheme	Irrigationnorm, m^3 /ha
1	1	1190 – 1360	1-2-1	5101
	2	439 - 887	1-3-1	3832
	3	437 - 833	1-4-1	3666
	4	576 – 1072	1-4-1	4763
2	1	1049 -1549	1-2-1	5622
	2	491- 980	1-2-1	3325
	3	494 - 676	1-4-0	3121
	4	642 - 895	1-4-0	4096
3	1	1176 - 1677	1-2-1	6277
	2	542 - 1137	1-4-0	4941
	3	530 - 789	1-4-0	3546
	4	696 - 1012	1-4-0	4639

Analyzes of the data in Table 2 show that, according to the scheme of field experience at production control, high soil moisture content was maintained due to the supply of large amounts of water (1049-1677 m^3 per hectare).

During the period of research, the average irrigation rate in the production control was 5101-6277 m^3 / ha (option 1). In the production control at the phase of growth of cotton development, the irrigation pattern was 1-2-1 and was irrigated 4 times. The irrigation period depending on the phase of cotton development was 28-35 days [8, 10].

In the experiment, it was proved that with a pre-irrigated soil moisture regime of 70-80-60% of MMC (option 3) is the best option.

Experimental site 1 (on light soils), in the variant with a regime of pre-irrigated soil moisture of 70-80-60% of MMC (3-variant), six vegetative irrigations with irrigation rates of 437-833 m^3 / ha were required. Under the scheme of watering 1-4-1. The irrigation rate in the years of research averaged 3666 m^3 / ha. The irrigation period was 14-32 days. Compared to production control, 2 irrigations were given more, but 1435 m3 of irrigation water per hectare was saved.

Experimental plot 2 (medium soils), in the variant with a regime of pre-irrigated soil moisture of 70-80-60% of MMC (3-variant), five vegetative irrigations were required, with irrigation rates of 494-676 m^3 / ha. under the scheme of watering 1-4-0. The irrigation rate in the years of research averaged 3121 m^3 / ha. The irrigation period was 18-21 days. Compared to production control, 1 more water was given, but 2500 m^3 of irrigation water per hectare was saved.

Experimental plot 3 (heavy soils), in the variant with the regime of pre-irrigated soil moisture of 70-80-60% of FWP (3-variant), five vegetation irrigations were required, with irrigation norms of 530-789 m^3 / ha. under the scheme of watering 1-4-0. The irrigation rate in the years of research averaged 3546 m^3 / ha. The irrigation period was 17-21 days.

As a result of all the above experiments and options, it was determined that the best option was the 3-option, that is, with the regime of pre-irrigated soil moisture 70-80-60% of the FWL.

To obtain 1 kg of raw cotton in option 1 (production control), the water productivity was 1.68-2.06 m^3. The average irrigation rate over the years of research per hectare of irrigated area was 5001-6277 m^3, and as a result cotton yield was 3.04-3.08 tons (Figure 2).

While maintaining soil moisture pre-irrigated at a level of 70-70-60% of MMC in version 2, to obtain one kg of raw cotton, the water productivity was 1.00-1.59 m^3. The average irrigation rate over the years of research per hectare of irrigated area was 3325-4941 m^3, as a result, cotton yields were obtained 3.1-3.31 tons [11, 12, 13, 14].

Analysis of the results of all experimental data show that the highest yield from raw cotton was obtained in the 3-variant, where the soil moisture pre-irrigated at the level of 70-80-60% of the MMC.

To obtain the maximum yield of cotton, an average of 3,121–3,666 m^3 / ha of water was required; also, to obtain 1 kg of cotton, water productivity was 0.78–0.91 m^3, and 3.93–3.02 tons of cotton were obtained.

To maintain soil moisture pre-irrigated at a level of 70-80-60% MMC (option 4) (for a cherry 30% normal), to obtain the maximum yield of cotton, an average of 4096 - 4763 m^3 / ha of water was required. To produce 1 kg of cotton, the water productivity was 1.13-1.34 m^3, the result was 3.55-3.76 tons of cotton.

To maximize the yield of cotton, you can reach through the application of agro technical and agro technological measures, as well as the necessary maintenance of optimal moisture in the soil. In conclusion, it can be noted that the result of irrigation of the soil was achieved by maintaining the pre-irrigated soil moisture at a level of 70-80-60% of MMC (Table 3) [8, 9, 10].

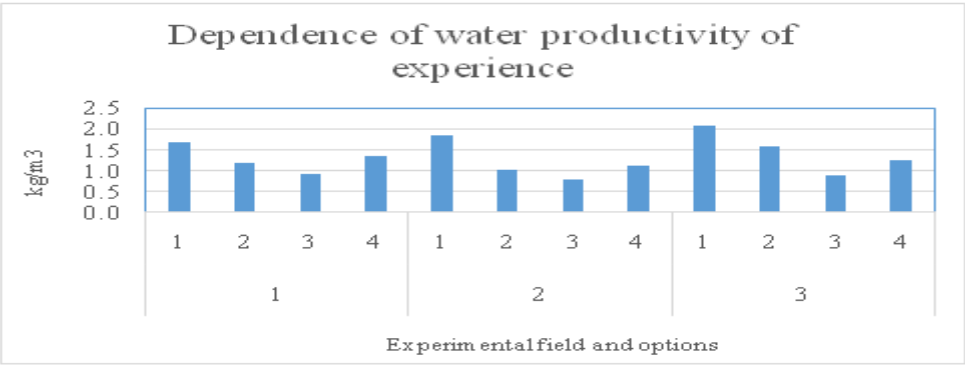

Figure 2. Changes in water productivity in the experimental plots and variants

Table 3 shows the water balance of the cotton field, where the water consumption of the cotton field is 5325-9706 m^3 / ha. Irrigation water of 3121-6277 m^3 / ha or 59-65% of them, ground water 635-1547 m^3 / ha or 11-16%, used soil moisture 908-1392 m^3 / ha or 14-17%, precipitation on average for research years 491 m3 / ha.

At the production control (option 1), to obtain 1 ton of raw cotton, irrigation water was supplied within 779 (test 2) - 913 (test 1) m^3, and total water consumption was 1828 (test 2) - 2062 (test 3) m^3 . By comparison with option 3, where irrigation was carried out at a mode of pre-irrigated soil moisture of 70-80-60% of MMC, 1049-1149 m^3 more water was used to produce 1 ton of raw cotton.

Option 2, where irrigation was carried out under a pre-irrigated soil moisture regime of 70-70-60% of MMC to obtain 1 ton of raw cotton, irrigation water 1004 (test 2) - 1589 (test 3) m^3 was fed, compared to production control (option 1) with saved per hectare of irrigated area within 473-824 m^3 of water.

Option 4, is that irrigation norms were carried out in the limits of 1133 (experiment 2) - 1343 (experiment 1) m^3 to obtain 1 ton of cotton crop. To maintain soil moisture of 70-80-60% of MMC (over-irrigation rate by 30%), compared to production control (option 1), irrigation waters of 336-695 m^3 are saved (table 3).

Table 3. Water balance of cotton field (Average over the years of research)

#	Accounting elements	Experiment 1				Experiment2				Experiment3			
		Options				Options				Options			
		1	2	3	4	1	2	3	4	1	2	3	4
1	Reserve of water in a layer of 0-100 cm at the beginning of the growing season, m^3 / ha	4128	4128	4128	4128	4533	4533	4533	4533	5154	5154	5154	5154
2	Water reserve in the layer of 0-100 cm. At the end of the growing season, m^3 / ha	2889	3013	3096	3220	3218	3332	3454	3545	3762	3814	3917	4046
3	Use of moisture from soil reserves, m^3 / ha	1238	1114	1032	908	1315	1201	1079	988	1392	1340	1237	1108
4	Precipitation, m^3 / ha	491	491	491	491	491	491	491	491	491	491	491	491
5	Irrigationrate, m^3 / ha	5101	3832	3666	4763	5622	3325	3121	4096	6277	4941	3546	4639
6	Use of moisture from groundwater, m^3 / ha	1312	830	807	857	1272	732	635	779	1547	1005	779	807
7	Total water discharge, m^3 / ha	8142	6267	5996	7019	8700	5749	5325	6354	9706	7777	6052	7045
8	Used from groundwater,% of total water flow	16	13	14	12	15	13	12	12	16	13	13	11
9	Used irrigation water,% of the total water flow	63	61	61	68	65	58	59	65	65	64	59	66
10	Yield, tons/ha	3,04	3,22	4,02	3,55	3,08	3,31	4,01	3,62	3,05	3,11	3,93	3,76
11	1 Total water consumption per 1 ton of crop, m^3	2680	1949	1493	1979	2828	1735	1330	1759	3190	2503	1541	1883
12	Irrigation water consumption from 1 ton of crop, m^3	1679	1192	913	1343	1828	1004	779	1133	2062	1589	903	1238

Thus, it was found that the best option for producing 1 ton of raw cotton was achieved at option 3, where irrigation was carried out with a pre-irrigated soil moisture regime of 70-80-60% of MMC.

In the case of water shortages, the main criterion for the rational use of water resources is the irrigation rate of crops. In the cotton field to obtain the required yield of raw cotton and rational use of water resources in the criterion of water use in the Khorezm oasis the research years amounted to 779 m^3 / ha.

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