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EFFICIENCY OF DRIP IRRIGATION TECHNOLOGY FOR COTTON IN SALINATED SOILS OF BUKHARA REGION

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Annotation.*Obtaining high and high-quality cotton yields and scientifically substantiating their hydraulic parameters through the use of water-saving irrigation technology in the conditions of salinity-prone soils of the Bukhara region.*

Key words: *water saving, irrigation rate, irrigation period, irrigation method, drip irrigation.*

Аннотация. *Получение высоких и качественных урожаев хлопчатника и научное обоснование их гидравлических показателей за счет применения водосберегающей технологии полива в условиях засоленных почв Бухарской области.*

Ключевые слова: *экономия воды, норма полива, период полива, метод полива, капельное орошение.*

Introduction. In recent years, effective measures have been implemented in Uzbekistan to enhance agricultural productivity and improve crop quality on irrigated lands through the efficient use of water resources, ultimately raising the living standards of the population. Across the country, from 2017 to 2021, water-saving technologies were introduced on 642.4 thousand hectares of land, including 308.6 thousand hectares with drip irrigation, 14.7 thousand hectares with sprinkler irrigation, 10.6 thousand hectares with discrete irrigation systems, 78.8 thousand hectares with flexible pipelines, and 20.9 thousand hectares with film-lined irrigation. Additionally, laser leveling was applied to 208.9 thousand hectares of farmland, bringing the total share of these improvements to 15% of all irrigated lands. As a result, in 2021 alone, a total of 10 billion cubic meters of water was saved, including 3.0 billion cubic meters specifically due to the implementation of water-saving technologies, which enabled the irrigation of additional crops.

Research objective. Obtaining high and high-quality cotton yields and scientifically substantiating their hydraulic parameters through the use of water-saving irrigation technology in

the conditions of salinity-prone soils of the Bukhara region.

Object of research:Scientific research on this topic was carried out on the irrigated lands of the "Bukhara AGRO" cluster in the Peshku district of the Bukhara region.

Subject of the study:The aim of the study is to assess the impact of drip irrigation of cotton on the reclamation regime of irrigated lands and on the growth and development of cotton, yield, and quality of cotton fiber in the conditions of meadow alluvial, light, and heavy mechanical soils of the Bukhara region.

Work execution style and experience system. Field and laboratory research, as well as phenological observations, were conducted based on the methodologies outlined in the “Methods for Conducting Field Experiments” (UzSRIC, 2007) by the Scientific Research Institute of Cotton Breeding, Seed Production, and Cultivation Technologies. Additionally, international DIN standards applied in research at Germany’s Leibniz Scientific Center and methodologies accepted at the ZALF Agro-technological Research Center were followed. In laboratory conditions, the determination of salt content was carried out using METPOHM-858 and SPEKORD-200 instruments, developed in Switzerland. The accuracy and reliability of the obtained data were ensured through mathematical and statistical analysis using the widely accepted multi-factor methodology of B.A. Dospekhov and the SPSS (Statistical Package for Social Science) software.

To achieve the stated research objectives, field experiments on cotton cultivation using drip irrigation technology were conducted in water-scarce regions of Bukhara province. The studies focused on the Bukhara-102 cotton variety, which is adapted to the Bukhara region. The seeds were sown using a specialized Chinese double-row film-covered planting technology, while the traditional 90/90 cm planting scheme was used as a control for comparison.

Table 1

Field experiments were carried out in the following system

Variant	Irrigation method and crop cultivation technology	Annual fertilizer rate, kg/ha		
		N	P	K
1.	Furrow irrigation (control)	Actual measurements		
2.	Drip irrigation technology	250	175	100

The experimental variants were conducted with three replications, and irrigation was carried out based on the pre-irrigation soil moisture level recommended by UzSRIC scientists, maintaining 70-80-65% of the limited field moisture capacity. In the control variant, cotton was cultivated using the standard agro-technologies applied in the region, including plowing, leaching of salts, pre-sowing irrigation for moisture accumulation, soil preparation before planting, sowing, maintaining plant density, inter-row cultivation, fertilization, irrigation, and weed control.

In the experimental variants, certain elements of the accepted agro-technologies were improved, such as modifications to the planting system (row spacing, plant density), reduction in the number of cultivations, and precise application of water and mineral fertilizers through drip irrigation based on plant requirements.

All scientific research activities conducted in the experiments, including various analyses, measurements, and phenological observations, were carried out in accordance with tested and accepted

Scientific research results: As a result of scientific research conducted on the meadow-alluvial, salt-prone soils of Bukhara region, the implementation of the drip irrigation system led to significant improvements. Compared to furrow irrigation, water savings of up to 30-40% per hectare were achieved, labor costs were reduced by 1.5-2 times, mineral fertilizer usage was decreased by 25-30%, and cotton yield increased by 4-5 centners per hectare.

Results and considerations. The irrigation norm for the control field per application was measured using a Chipoletti water meter. When calculating the irrigation norm, the soil's water-physical properties and moisture penetration depth were taken into account to determine the required soil moisture level. The irrigation norm for the control field per application was determined using the following formula by S.N. Rijov.

The irrigation norms for the control fields were calculated using the following formula.

$$m = 100 \cdot h \cdot J \cdot (W_{чДНС} - W_{хн}) + K \qquad м^3 / га$$

bu yerda: W_{CHDNS} – limited field moisture capacity relative to soil weight, %;

W_{hn} - Actual soil moisture before irrigation relative to soil weight, %;

J – bulk density of soil, g/cm^3 ;

h – calculated layer value, m;

k – Water consumption for evaporation during irrigation, m3/ha (replacement of moisture deficiency in the calculation layer) 10 % i).

Irrigation of cotton in the experimental fields was carried out based on the system established in the scientific research program. The irrigation schedules and norms for each variant were determined according to the soil moisture content.In the second variant, the irrigation norm was determined based on soil moisture at different growth stages during the germination to flowering phase, moisture in the 0-50 cm soil layer was considered, during the flowering to boll formation phase, moisture in the 0-70 cm soil layer was taken into account, during the cotton maturation and boll opening phase, irrigation was based on the soil moisture content in the 70-100 cm layer..

Variants	Indicators	IRRIGATIONS, M³/HA								Irrigation system	Seasonal irrigation rate, m³/ha
		1	2	3	4	5	6	7	8		
1	Irrigation rate, m^3/ha	1064	1170	1176	1194	980				1-3-1	5584
2	Irrigation rate, m^3/ha	386	392	432	448	480	471	385	345	2-5-1	3339

Based on the results obtained from the research conducted in the experimental and control fields, as presented in table 2, irrigation in the production control variant followed the 1-3-1 scheme, with cotton being irrigated five times during the vegetation period. after sowing, from seed germination to flowering and during the flowering-fruiting phases, large irrigation norms (1170-1240 m³/ha) were applied to ensure consistently high pre-irrigation soil moisture levels in the targeted soil layer. during the crop maturation phase, cotton was irrigated at lower rates. the total seasonal irrigation norm amounted to 4780 m³/ha, with irrigation intervals of 19-21 days.in the second variant, where drip irrigation was applied, irrigation followed the 2-5-1 scheme, with cotton being irrigated six times. from seed germination to flowering and during the flowering-fruiting phases, irrigation norms of 462-488 m³/ha were applied. the total seasonal irrigation norm amounted to 3339 m³/ha, which was 1916 m³/ha less than in the control variant. the interval between irrigations ranged from 12 to 14 days, and the total irrigation duration was between 6^{20} and 6^{50} hours.

*Changes in the level and mineralization of groundwater in the experimental field:*the formation regime of groundwater level and mineralization is one of the key indicators for assessing the reclamation state of irrigated lands. the groundwater regime is determined by various factors, including surface topography, lithology, climate, hydrogeological and hydrological conditions, as well as human irrigation and agricultural activities.According to the results obtained on changes in groundwater mineralization in the experimental and control fields, the mineralization of groundwater in the experimental production fields ranged from 2.3 to 3.0 g/l.observations

conducted during the vegetation period on the impact of drip irrigation on groundwater mineralization in the experimental field showed that in the 2nd and 3rd variants, where irrigation norms were designed to compensate for the moisture deficit in the active soil layer, the mineralization of groundwater changed relatively little by the end of the vegetation period.In contrast, in the 1st (control) variant, where large irrigation norms were applied, groundwater mineralization increased to 2.315-3.250 g/l after irrigation. this increase was due to the infiltration of irrigation water, which carried soluble salts from the soil into the groundwater.

The influence of irrigation methods and procedures on the growth and development of cotton: Phenological observations on the growth and development of cotton indicate that maintaining an optimal water regime in the root zone of plants in saline or salt-prone soils depends on the composition and amount of water-soluble salts in the soil, which determine the direction of physiological processes in plant tissues.

Table 3

The effect of irrigation method on the growth and development of cotton.

Variants	Chin leaf, cm	Length of cotton, cm				Number of harvested branches, pcs.		Number of pods, pcs.		
	1.06	1.06	1.07	1.08	1.09	1.07	1.08	1.08	1.09	1.09 opened in
1	3,4	12,8	32,8	71,8	90,0	8,5	12,6	7,8	10,6	4,1
2	3,5	12,2	32,4	73,4	89,7	9,1	13,7	8,7	13,5	5,6

The results of observations in the experimental and control fields showed no significant differences in cotton seedling density between the variants. Phenological observations indicated that in the drip-irrigated 2nd variant of the experiment, the number of fruiting branches was 13.7, the number of bolls was 13.5, and the number of open bolls by September 1 was 5.6. Compared to the control variant, this represented an increase of 1.1 in fruiting branches, 0.9 in the number of bolls, and 1.5 in the number of open bolls by September 1.

In the 1st (control) variant, over the years of research, the number of fruiting branches was 12.6, the number of bolls was 10.6, and the number of open bolls by September 1 was 4.1.

The effect of irrigation method on cotton yield and cotton mass per bushel: Scientific research conducted in the experimental and control fields analyzing the cotton yield of the Bukhoro-102 variety showed that in the 1st (control) variant of the study, the highest water consumption was recorded at 133.5 m³ per centner of cotton produced, resulting in a cotton yield of 35.8 centners per hectare.

Table 4

Effect of drip irrigation on cotton weight per bale.

Variants	Cotton weight per bale by returns,gr			Average, grams.	Additional mass, grams compared to control.	Water consumption per 1 quintal of cotton, m³/s
	I	II	III			
1	4,5	4,8	4,0	4,4	0,0	133,5
2	6.2	6.1	6.2	6.2	+ 1.8	73,6

In the drip-irrigated 2nd variant, the lowest water consumption for producing one centner of cotton was 87.6 m³/s, and the highest cotton yield was 44.9 s/ha. This is 16.1 s/ha more than the control variant.

Table 5

The effect of irrigation method on cotton yield.

Variants	Cotton yield by returns, c/ha			Average yield, c/ha	Additional yield, compared to control ± c/ga	Water consumption for 1 c of cotton harvest, m^3/s
	I	II	III			
1	35,5	35,8	36,0	35,8	0,0	133,5
2	44.8	45.0	44.9	44.9	+ 9.1	73,6

The effect of drip irrigation on the weight of cotton per bale is shown in the table, which shows that in fact, when drip irrigation is used, the weight of cotton per bale increases and its quality improves.

Conclusion: Based on the analysis of the scientific research conducted to study the efficient drip irrigation method for cotton cultivation in the Bukhara region, the following conclusions can be drawn:In the experimental field where cotton was cultivated, at the beginning of the vegetation period, the soil water permeability over 6 hours was 960 m^3/ha or 0.27 mm/min. By the end of the vegetation period, in the drip-irrigated 2nd variant, the soil water permeability over 6 hours decreased to 736 m^3/ha or 0.21 mm/min. Compared to the control variant, soil water permeability in the drip-irrigated variant was 88 m^3/ha or 0.06 mm/min higher over 6 hours.At the beginning of the vegetation period, the bulk density of the soil in the 0-30 cm plow layer was 1.24 g/cm^3, and in the 0-100 cm layer, it was 1.34 g/cm^3. By the end of the vegetation period, in the drip-irrigated 2nd variant, the bulk density of the soil in the 0-30 cm plow layer increased to 1.26 g/cm^3, and in the 0-100 cm layer, it increased to 1.35 g/cm^3, showing an increase of 0.02-0.03 g/cm^3.

Since traditional practices such as furrow dragging, furrow breaking, inter-row cultivation, hoeing, and other agro-technical measures were not carried out in the drip-irrigated variant, economic efficiency was achieved.

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IMPACT OF IRRIGATION OF REPEATED CROPS TREATED WITH BIOPRODUCTS WITH LOW-MINERALIZED ROOT WATER ON YIELD

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Abstract.*This article presents data on the effect of Nanosilicon, Aminosid universal si, and biopreparations on the yield of sunflower crops grown in the Bukhara oasis on alluvial, moderately saline, medium-sandy soils with a groundwater level of 2.0-2.5 meters and a mineralization of 2.5-3.0 g/l.*