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Water-Physical Properties Of Soils In Drip Irrigation Of Cotton

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Abstract.

The article presents the results of the research conducted on the study of the processes that took place in the water-physical parameters of the stands during the maintenance of cotton varieties under different irrigation technologies in the conditions of the fields of the southern region of Uzbekistan. In this, 5 varieties of cotton (Bukhara-102, Sultan, Istiqlal-14, SP-1607 and Surkhan-106) were studied under irrigation and drip irrigation (TS). In the experiment, irrigations were carried out in different order (65-70-65 in TS, 70-70-65 percent in control watered with 70-75-65) according to limited field moisture capacity of the soil (ChDNS). As a result of scientific research, Istiqlal-14 and SP-1607 varieties of cotton were accepted as suitable for growing cotton in TS fields, and they were recommended for planting in production. It should be noted that the basic water-physical properties of the soil, such as volume mass, porosity, and water permeability, were improved in TS compared to the irrigated areas, the water consumption during irrigation was reduced by 40-45 percent, and the cotton yield was 10-15 percent higher. In general, drip irrigation has been found to be an effective technology in cotton care under the hot and dry climate conditions of the southern region.

Keywords: water-physical properties of the soil, cotton, irrigation and drip irrigation, humidity, calculation layer, volume mass, water permeability, productivity.

Introduction

Cotton growing is the main branch of agriculture in Uzbekistan. Global warming of the climate, economic development, and demographic growth of the population observed in recent years require the economical use of the land and water resources available in the country, which are decreasing year by year. Despite this, high results are achieved by applying irrigation and resource-efficient technologies in the agrotechnological system of caring for cotton, which is an Asian crop. In particular, in recent years, drip irrigation of cotton fields and laying polyethylene film between the rows and application of mineral fertilizers dissolved in water (fertigation) and distribution of water during irrigation through artificial flexible pipes create an opportunity not only to save water, but also to use fertilizers efficiently.

Resolution PQ-4499 of the President of the Republic of Uzbekistan dated October 25, 2019 "On measures to expand the mechanisms for promoting the introduction of water-saving technologies in agriculture" and

President of the Republic of June 17, 2019 "On measures for the effective use of land and water resources in agriculture" According to the decree No. PF-5742, the forecast indicators for the introduction of water-saving technologies on 253,381 ha of cultivated land for the years 2019-2022 have been approved, and they are defined in other regulatory and legal documents related to this activity. Decree No. PF-6024 of the President of the Republic of Uzbekistan dated July 10, 2020 "On approval of the concept of water management development of the Republic of Uzbekistan for 2020-2030" was adopted. Decision PQ-144 of the President of the Republic of Uzbekistan dated March 1, 2022 "On measures to further improve the introduction of water-saving technologies in agriculture" and other regulatory legal documents related to this activity.

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Materials and methods

For the soil and climate conditions of the central and southern regions of the republic, the root system is adapted to drip irrigation, the selection of cotton varieties resistant to drought, heatstroke, and the development of effective agrotechnologies for their maintenance.

Specific tasks that serve to solve this problem include the following:

- To study the soil moisture before and after irrigation in the TST field and the amount of water used for irrigation in a generalized way according to the phases of growth and development of cotton;
- agrophysical and hydrophysical properties of the soil (bulk weight, porosity, water permeability, limited field moisture capacity) are studied when TST is used in the maintenance of cotton varieties;
- phenological observations are made on the growth and development of the plant when using TST in the irrigation of tested cotton varieties;
- it is determined that the yield elements of different cotton varieties are shed under the influence of extremely high temperature and heat;
- observation works on morpho-economic characteristics of cotton varieties are carried out according to experimental options, individual and family selection works are carried out on new cotton ridges;
- Irrigation periods, norms and number of irrigations and seasonal water consumption indicators of cotton varieties are determined;
- the coefficient of transpiration rate is determined according to the development phases of cotton varieties;
- In research on testing cotton varieties under different irrigation conditions, the effect on cotton yield, cotton weight per boll, and fiber quality indicators is determined.
- Designing the technology of drip irrigation of cotton varieties in the selected experimental areas (pump, feeding device, filters and drip irrigation system), selection and installation of the necessary equipment;
- Analysis of data on the soil-climate, hydrogeological and land reclamation conditions of the experimental area;
- Monitor the balance of total water consumption (irrigation period, number of irrigations and duration of irrigation) during drip irrigation of selected cotton varieties;

- Monitoring the amount of water used in drip irrigation of cotton and the depth of wetting of the soil through drip irrigation, the duration of drip irrigation and water consumption in drippers at specified points;
- Regular monitoring of soil moisture (wetting area and depth). Analysis of the design of elements in the drip irrigation system and hydraulic parameters, taking into account the water supply of the irrigated land area;
- Development and implementation of measures to increase the reliability of the drip irrigation system taking into account the level of turbidity of the water in the water source;
- Development of washing technology of irrigation pipes and hoses, taking into account the relief of the drip irrigation areas and the length of irrigation egates;
- Dismantling and conservation of the drip irrigation system at the end of the growing season.

Ilmiy ishning yangiligi. Илк бор илдиз тизими томчилатиб суғоришга мослашган, қурғоқчиликка ва гармселга чидамли янги ғўза навларини танлаш ҳамда уларни парваришлашда ТСТни қўллашнинг мақбул суғориш тартибини аниқлаш бўйича илмий тадқиқотлар Республикамизнинг типик бўз ва тақир ўтлоқ тупроқлари шароитларида чуқур ўрганилиши ишнинг янгилигидир.
The practical significance of the scientific work: the root system of cotton in the typical gray soils of the Tashkent region and the barren grassland of the Surkhandarya region is suitable for drip irrigation, it is of scientific importance with the technology of obtaining a high and quality cotton crop by applying the number, optimal duration and standards of irrigation in the garmsel-resistant cotton varieties.
The practical importance of the research is in the selection of cotton varieties resistant to germs, suitable for drip irrigation. In the resource-saving method of irrigation, water consumption is reduced by 40-45%, productivity increases by 10-15%, and scientific and practical recommendations are developed for the heads of farms and agroclusters to achieve high economic efficiency and profitability. It is also explained by reducing the negative consequences of increasing water scarcity and protecting the environment through the use of TST.

Results and discussion

Field experiments were conducted on the fields covered with barren meadow soils of the Scientific Research Institute of Cotton Selection, Seeding and Cultivation Agrotechnologies (PSUEAITI) in Termiz district of Surkhandarya region. Surkhandarya region is located in the southernmost part of Uzbekistan and is surrounded by mountains on three sides. It is bordered by the mountains of the Zarafshan range from the north, Kuhitang from the west, and Bobotog from the east. Amudarya flows through the south of the province. The experimental area in Termiz district is located 310 meters above sea level, and it is considered one of the regions with scorching hot summer and harsh winds.
A dry hot southwesterly wind characteristic of this region is called "Afghan wind", garmsel blows continuously with great force for 2-3 days. This situation reaches 35-37 days a year. In addition, dry winds blow for a long time.
In this area, it should be noted that the temperature rises to the highest level in July-August of the year. It was found that the hot Harmsel wind, which blows many times during these months, has a great negative impact on the growth and development of agricultural crops, including cotton. It was also observed that during the season, as a result of the increase in air temperature, the relative humidity accumulated in the soil decreases, the soil surface dries up quickly, and the elements of the cotton crop are thrown away.
Local scientists have studied the effect of water-physical properties of the soils of Central Asia, especially Uzbekistan, on the water-nutrition regime of cotton, its growth and productivity. For the region of cultivated and old irrigated gray soils, they accepted 1.25-1.30 g/cm3 as an acceptable indicator of bulk density. Also, these scientists showed that the highest index of volume mass of the driving layer of soil can reach 1.5 g/cm3 in heavy mechanical soils.
In the areas where the field experiments were conducted, the volumetric mass and porosity of the soil were studied under field conditions. These indicators are considered one of the most important agrophysical properties and have an effect on the spread of the root system of the plant in the soil layer, the uniform growth of the above-ground part, the formation of crop elements and the increase in productivity. In the research, before placing the experimental options in early spring, the volume mass of the soil was determined from three points along the diagonal of the field to the depth of 0-100 cm in every 10 cm layers, and the porosity was calculated based on the specific gravity (2.70 g/cm3).

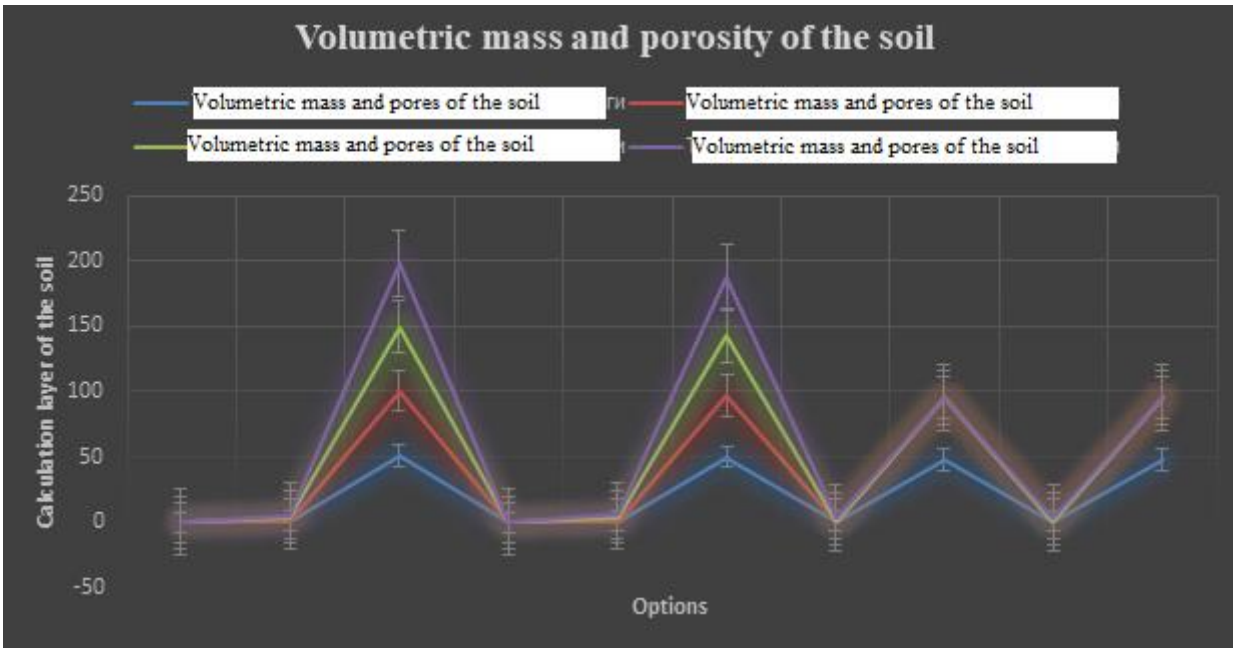

Figure 1. Volumetric mass and porosity of the soil

It can be seen from the data that in the conditions of the barren meadow soils of Surkhandarya region, the volume mass and porosity indicators are by layers, that is, 1.28 g/cm3 and 50.7% in the 0-30 cm layer, 1.31 g/cm3 and 49.6 in the 0-50 cm layer. %, in the lower 0-70 cm and 0-100 cm layers averaged around 1.32-1.34 g/cm3 and 48.4-49.2, respectively. It is also possible to see the following pattern, that is, from spring to late autumn and from the surface of the soil to genetic layers, increasing the volume mass (up to 1.4 g/cm3) and decreasing the porosity (45 %) was observed. As a result of detailed analysis, it can be seen that despite the fact that cotton is grown in different soil conditions, the parameters of bulk mass and porosity are not affected by plant varieties. Because, it has been emphasized by many scientists that the agro-physical properties of the soil hardly change in a short period of time (2-3 years). At the end of the vegetation period, the volume weight of the soil was determined according to the options. In this case, according to the results of observation, at the end of the vegetation period, the volume weight of the soil in the 0-50, 0-70 and 0-100 cm layers of the soil is 0.04-0.05-0.03 g/cm3, or 5 -7%, and in drip-irrigated options, these indicators were significantly less, 0.01-0.02-0.01 g/cm3, or 3-4%. It should be recognized that the highest indicator of the volume mass of the soil was 10-12% in the control when comparing the control variant with TS variants. The volume mass of the soil and, at the same time, its porosity, were caused by the number of irrigations during the season, their rates, and the transition of seasonal tillage techniques between the rows.

A pool of water storage in drip irrigation

Drip irrigation technology equipment

The water permeability of the soil is considered to be an important water-physical property, and it varies depending on the mechanical composition, morphological and structural structure, the level of absorption and vegetation cover, the level of underground water, the level of technical treatment between the rows, the level

of seepage water and other factors. . At the same time, this feature of the soil, especially in the irrigated areas, is a different indicator, changing sharply from the beginning to the end of the period of operation under the influence of the number and standards of direct irrigation. Water permeability was determined in early spring at 3 points along the diagonal of the experimental field, and in autumn according to irrigation methods and procedures. Table 2 shows the results of observations made in the field to determine the water permeability of the soil. From the information presented in the table, it can be seen that as a result of soil compaction during the season, its water permeability also decreased.

Table 2 Soil permeability, m3/ha (mm/min)

Options	**Indicators**	**Hours**						**6 on the hour**
		1	**2**	**3**	**4**	**5**	**6**	
The beginning of the period of action.								
In the general background	m^3/ha	326	152	109	63	49	33	732
	mm/min	0,54	0,25	0,18	0,10	0,08	0,05	1,22
End of validity period								
Drip irrigation	m^3/ha	245	105	79	59	39	31	558
	mm/min	0,40	0,17	0,13	0,09	0,06	0,05	0,93
Drip irrigation (65-70-60)	m^3/ha	259	129	91	52	36	29	596
	mm/min	0,43	0,21	0,15	0,08	0,06	0,04	0,99
Drip irrigation (70-75-65)	m^3/ha	256	123	77	54	32	28	573
	mm/min	0,42	0,20	0,12	0,09	0,32	0,04	0,95

The water permeability of the soil was 1715 m^3/ha in spring (experiment 1) in weakly saline soils (for 6 hours) and 1500 m3/ha in moderately saline soils. It should be noted that the water permeability of the soil was equal to 305-275 m^3/ha in the first hour of observation, then it decreased in the following hours, and in the sixth hour, water absorption was equal to 65-85 m^3 per hectare.

The rate of water infiltration into the soil was 0.87 mm/min (87 m^3) in the first hour, but did not exceed 0.11 mm/min (11 m^3) in the sixth hour. Also, the observations show that the water permeability of the soil decreased slightly in the autumn as a result of the irrigations during the growing season and their rates, as well as the transition of the techniques working between the rows, which led to the compaction of the soil.

It has been proven once again that the use of drip irrigation system is an effective agrotechnical measure in the care of medium and thin fiber cotton varieties in the conditions of barren meadow soils of Surkhandarya region. Drip irrigation allows maintaining the agro-physical and water-physical properties of the soil in an optimal condition, ensures uniform wetting of water in the field, and has a positive effect on the good growth and development of cotton and high yield.

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