PHYSIOLOGICAL INDICATORS OF PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS IN COLORED AND WHITE FIBER SAMPLES OF G. HIRSUTUM L. COTTON

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Abstract. *In the article, physiological and single leaf dry weight parameters such as total water content, transpiration rate and water retention properties of plants were studied in the colored and white fiber samples of cotton G. hirsutum L. under optimal, water deficit and salinity conditions. In this case, in the colored and white fiber samples of cotton G. hirsutum L., physiological parameters such as total water content, transpiration rate, and water retention properties of plants decreased under stress conditions compared to optimal conditions under different environmental conditions, while the dry weight of one leaf decreased and increased.*

Keywords: *G. hirsutum L., cotton, physiology, water deficit, salinity.*

Introduction

Cotton is one of the main agricultural crops of the Republic of Uzbekistan, and its importance in the national economy is extremely incomparable. About 200 products are obtained from it, which are widely used in industry, medicine and other fields. The fiber, which is the main product of cotton, is used to make yarn, thread, fabrics and other products. Part of the yarn and textile industry products produced in our republic is exported abroad and serves to enrich the foreign exchange reserves of our country. At present, the science of cotton growing in our republic is faced with the task of creating and introducing new varieties of cotton that are early ripening, productive, with a high quantity and quality of fiber, resistant to abiotic (drought, salinity, high and low temperatures) and biotic (diseases, pests) stress factors of environment. Decree of the President of the Republic of Uzbekistan PD-No. 60 dated January 28, 2022 “On the development strategy of New Uzbekistan for 2022-2026” provides for “the creation and introduction of new breeding varieties of agricultural crops adapted to local soil, climatic and environmental conditions.” When performing these tasks, cotton gives natural dyed fiber and thereby saves a lot of money spent on dyeing yarn and fabric with various chemical dyes in the textile industry, is environmentally friendly and absolutely beneficial for the human body.

It can also be widely used in the field of medicine. Because, according to scientific sources, dyed fiber has the properties of bactericidal, non-allergic elimination of skin dermatosis and allergic inflammation, restoration of burnt and cut tissues, that is, it is of great importance in hygiene. Due to its hydrophobicity, it is used in the Navy and in space, it also has fungicidal and virucidal properties. Obtaining plant-based biological color enzymes makes it possible to use them for food and pharmacological purposes. Due to the fact that cotton from dyed fiber is not affected by pathogens, pesticides are not used against them, which ensures the transformation of cottonseed oil into a pure food product for humans, an increase in the content of cottonseed oil by 1-2%, makes cotton feed for livestock harmless [3].

Of great scientific and practical importance is the creation and introduction of new types of dyed fiber in the textile industry, which satisfy the domestic demand for fiber and make it possible to produce export-oriented products. When creating such varieties, fundamental research aimed at the widespread use of existing genetic and physiological methods and their further improvement is of relevant and necessary importance.

A lot of research work has been carried out on dyed cotton fiber, including N.I. Fursov (1995) created a natural fiber chain Genetik-34, Genetik-37, Genetik-38, Genetik-40. [3] .

According to Gizem K. G. (2018), as global interest in pure organic fabrics grows, naturally colored cotton fiber is becoming an important resource in the textile market. Because the processing of fiber in the textile industry requires the use of large amounts of water, energy, chemicals and other related resources. The use of chemical dyes in the fiber dyeing process can lead to environmental pollution. The use of natural dyed fibers in the textile sector reduces environmental risks and waste generation [5].

H. Saidaliev, M. Khalikova, R. Rakhmonova (2009) studied the manifestation of some economic characteristics in samples of dyed cotton fiber. They noted that most of the samples with dyed fiber have not been studied for the purpose of introducing them into wide production due to their some lateness and low quality of the fiber, that at the same time, varieties created on the basis of such samples have a number of advantages, that is, they are not needed to dye, and natural colored fiber fabric is harmless to health and does not cause various allergic conditions. The authors, considering that the difference in fiber color in some samples of green fiber in different parts of the plant is associated with the sensitivity of the color-determining pigment to sunlight, and came to the conclusion that the efficiency of using such a colored fiber is low [6].

Methodology and research conditions

The objects of our research were colored (brown, greenish) and white samples of fibers belonging to the type of medium fiber G. hirsutum L., in the collections of the cotton gene pool of the research institutes of Genetics and Experimental Biology of Plants of the Academy of Sciences of the Republic of Uzbekistan and Agrotechnology of selection, sowing and cultivation of cotton of the Ministry of Agriculture of the Republic of Uzbekistan . They were planted under conditions of lysimeters of optimal water supply (irrigation scheme 1-2-1) and water deficit (irrigation scheme 1-1-0) and on a moderately saline background with sulfate-chloride import from the Syrdarya region. The amount of water poured into the lysimeters was recorded on an electronic water meter. At the same time, the total amount of water used for irrigation on the background of optimal water supply was 4500 m^3/ha, and on the background of water shortage - 2800-3000 m^3/ha. [7,9,10].

Such physiological indicators during the flowering period of plants on the background of optimal water supply, water deficit and average soil salinity with chloride sulfate, such as the total water content of plant leaves, the water-retaining capacity of plant leaves [4], the property of transpiration intensity [1], the mass of one dry leaf [2, 8,11] were determined by physiological methods.

The physiological indicators of plant water exchange in these samples - the total amount of water in the leaves, the intensity of transpiration, the indicators of water-retaining capacity of the leaves - on the background of soil moisture, the optimal water regime are 70-72% in relation to the limited field water capacity (LFWC) and 48-50% - on the background of water deficit, were studied during the period of gross flowering of plants.

Table 1

Objects of study and fiber colors:

	Sample	Fiber color
	b/n, green fiber	green fiber
	A-800	light green fiber
	Color № 14	green fiber of a red plant
	010108	dark brown reddish fiber
	Gulshan	white fiber
	Sadaf	white fiber
	04489	light brown golden fiber
	010765	dark brown fiber

Research results and discussion

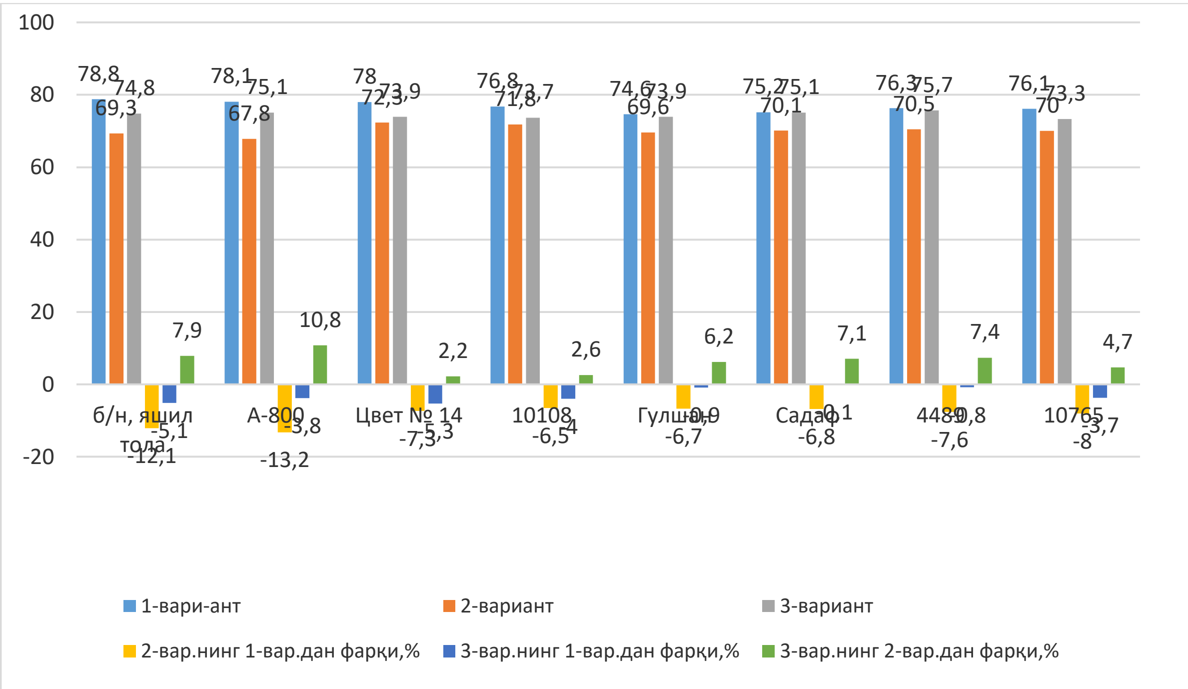
When studying the total moisture content of leaves in cotton samples, the highest value on the optimal background was in green fiber w/n (No. 1) and amounted to 78.8%. In samples No. 2 and No. 3, the trait indicators were high compared to the rest of the samples, 78.1% and 78.0%, respectively, and the lowest indicator was in sample No. 5, that is, in Gulshan variety, which was 74.6% .

The total water content in the leaves decreased to varying degrees in all the studied genotypes under conditions of water deficit compared to the optimal water regime. On the background of this stress, the highest rates of the trait were in samples No. 3 and No. 4, 72.3% and 71.8%, respectively, and the lowest rates were in sample No. 2, 67.8%.

On the background of average soil salinization with chloride sulfate, the highest indicators of the total water content were in the leaves of varieties and samples No. 7, No. 2 and No. 6 - 75.7%, 75.1%, 75.%, respectively, and the lowest in sample No. 8 and amounted to 73.3%.

Figure 1

The total water content in the leaves of samples of colored and white cotton fiber of G. hirsutum L.,%



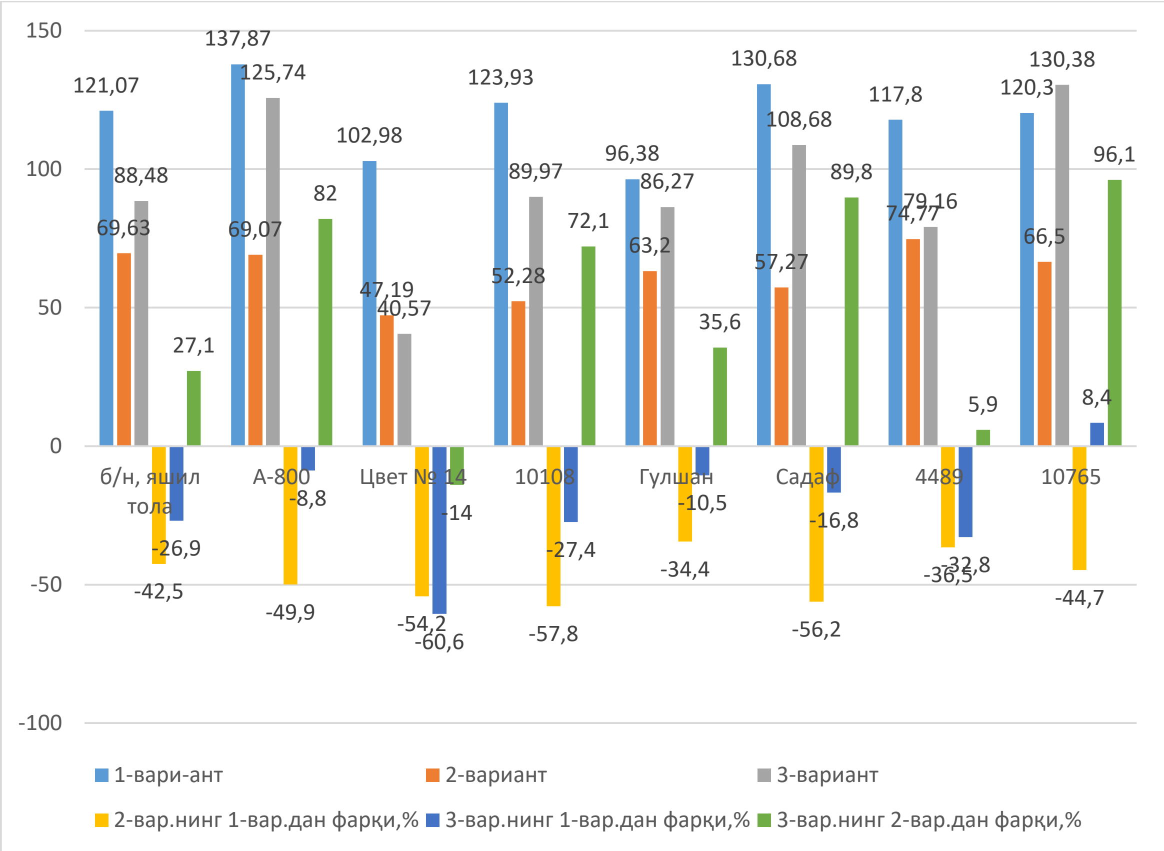
The optimal water supply of the soil ensured a high rate of transpiration of plant leaves. Among the 8 studied samples, the highest values of the trait had cultivars A-800 and Sadaf (137.87 mg and 130.68 mg H_2O, respectively), and the lowest transpiration values had cultivar Gulshan (96.38 mg).

The lack of water in the soil caused a sharp decrease in transpiration in all genotypes. In this background, the highest transpiration rate was noted in sample no. 7 (74.77 mg H_2O), and the lowest in samples no. 3 and 4 (47.19 mg and 52.28 mg, respectively).

In the background of salinity, in comparison with OB, only sample No. 8 had a high value (130.38 mg), while in all other samples it decreased to varying degrees. A relatively high transpiration rate was noted in samples A-800 and Sadaf variety (125.74 mg and 108.68 mg, respectively), and the lowest was in sample No. 3, which amounted to 40.57 mg.

Figure 2

The intensity of transpiration in the leaves of samples of colored and white cotton fiber of G. hirsutum L. under various environmental conditions, mgH_20/1 g of wet leaf x 1 hour

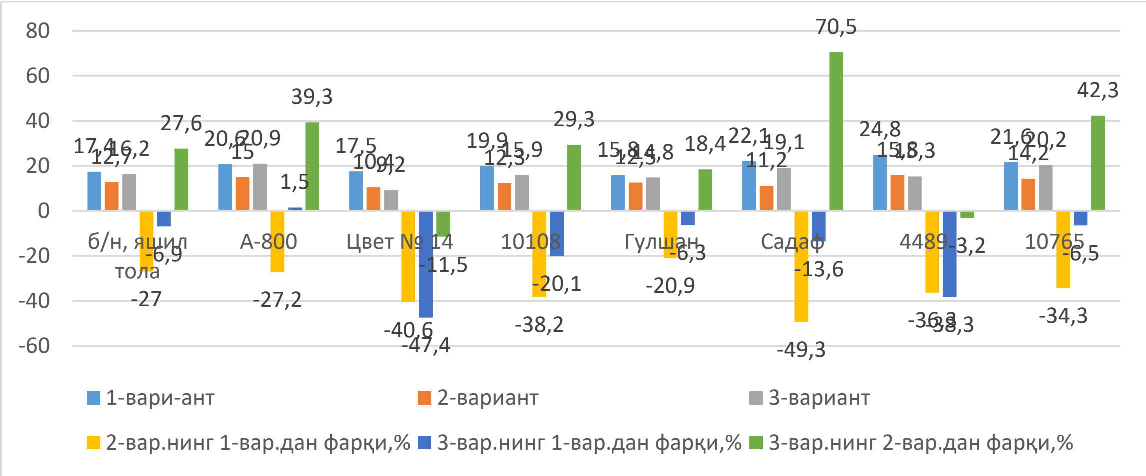


Under the optimal water regime, the water-retaining capacity of the leaves was low and amounted to 15.8-24.8%. WRCL was the highest in variety Gulshan, 15.8%, and the lowest in variety No. 7, 24.8%. WRCL increased to varying degrees in all samples with water deficit. Against this background, WRCL was the highest in varieties and samples No. 3 and No. 6, 10.4% and 11.2%, respectively, and the lowest in samples No. 7 and No. 2, 15.8% and 15.0%, respectively.

In the background of soil salinity, samples No. 2 and No. 5 did not significantly differ from the OB in terms of WRCL; in other cases, WRCL was higher compared to OB. Against this background, the highest rates of WRCL were noted in sample No. 3 (9.2%), and the lowest in varieties and samples No. 2, No. 8 and No. 6 (20.9%, 20.2%, 19.1%, respectively).

Figure 4

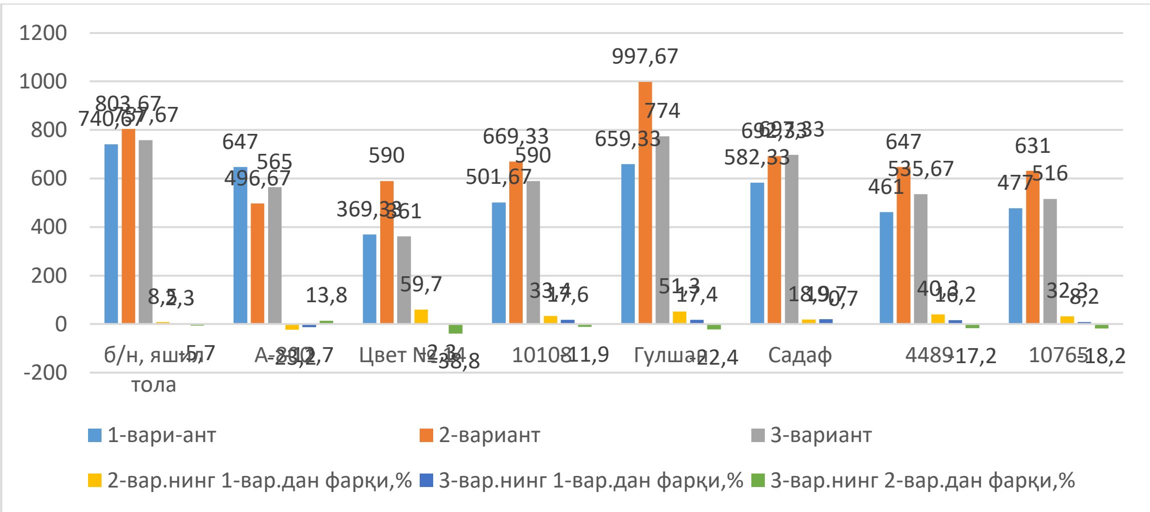
Water-retaining capacity of leaves of plants of colored and white samples of cotton G. hirsutum L., %



The weight of one dry leaf in all varieties and samples increased to varying degrees under conditions of water deficit and soil salinity. In sample No. 2, the OB was higher compared to other options. The difference between the OB and salinity background turned out to be statistically unreliable.

Figure 5

The weight of one dry leaf of colored and white samples of cotton G. hirsutum L., mg



Conclusion

From the experiment, it can be concluded that in samples of colored and white cotton fiber of G. hirsutum L. under various environmental conditions, such physiological indicators as total humidity, transpiration intensity and water-retaining properties of plants decreased under stress conditions compared to optimal conditions, and the cases of decrease and increase were determined by the weight of one dry leaf.

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