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STUDY OF MORPHO-PHYSIOLOGICAL TRAITS OF FINE-FIBER VARIETIES AND COTTON LINES IN DIFFERENT IRRIGATION REGIMES

Abstract: *The article presents the results of water content and intensity of leaf transpiration in fine fiber varieties and cotton lines in different conditions of water regime. Compared to optimal water availability, water content and leaf transpiration intensity decreased depending on the individual genotypic response of fine fiber varieties and cotton lines to the lack of soil moisture in the soil.*

Key words: *fine-fiber cotton varieties, water regime, water content, leaf transpiration, different condition, G. barbadense L.*

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Introduction

Cotton is an important source of the country which provides raw materials for textile, food, chemical, and other industries. One of the main cotton productions is fiber. In the world market, the countries with a high yield of cotton fiber are the USA, Egypt, Israel, Australia, and Uzbekistan, whereas countries with a low yield of cotton fiber are the states of Asia, Africa, Oceania, Europe, and South America [2]. According to statement of Abdurakhmonov [3], the main goal of the world breeding programs for cotton is to increase productivity and improve fiber quality [6]. In the world market of cotton, fine-fiber cotton, i.e. varieties of *G.barbadense L.* are estimated to be 1.5-2 or more times more expensive than fiber of *G.hirsutum L.* With one ton of fine fiber, 1.3-2.0 times more and more expensive fabric is obtained than with one ton of *G.hirsutum L* fiber varieties. [4]. *G.barbadense L* is the youngest, plastic species and originated from South America [5]. Globally, 9% of the total cultivated area under cotton is allocated to varieties of the species G. barbadense L. In the past these species was mainly sown on the shores of the islands and plains of the United States and was famous under the name of Sea Island. Besides, cotton land covered the Nile Valley of Egypt and began to be grown in the country [6]. However, Pima's fine fiber made up only 3% of world cotton production, they are considered commercial varieties that produce high quality fiber. Pima are the mainly grown in the western and northwestern regions of the United States and also in large areas of China [7]. In 2012, 94% of the total sown of Pima was in the San Joaquin Valley of California, and Arizona, New Mexico and Texas [8]. Uzbekistan is one of the countries in the world that has adopted the cultivation of fine-fiber cotton. The republic in the cultivation of fine-fiber varieties occupied the second place after Egypt [9]. With limited water resources and the noticeable impact of global climate change on agriculture require the development and implementation of water-saving agricultural technologies. One of such agricultural technologies is the creation of drought-resistant varieties of agricultural crops, including fine-fiber cotton, the cultivation of which were in the southern regions of the republic in recent years has received special attention from the government of the country. The large-scale basic and applied research has been conducting on fine-fiber cotton by scientists (R.G. Percy, [10]; A.G. Abdel-Hafez et al. [11]; Gamal I. A. Mohamed et al. [12] and others [13] who studied economically valuable traits, inheritance, and variability in fine fiber cotton. Abdullaev A.A. [14] also carried out a research on the molecular labeling of fiber features and resistance to fusarium mobility, associative mapping and linkage disequilibrium mapping in germoplasma *G.barbadense L*. Moreover, scientists in the field of agriculture (A. I. Avtonomov, A. A. Avtonomov, Yu. P. Khutornoy, M. I. Iksanov, A.P. Tyaminov, Vad. A. Avtonomov, Vik. A. Avtonomov and O. Kh. Kimsanboev) made a contribution to creating many fine-fiber varieties such as S-6029, S-6030, S-6032, S-6037, S-6040, S-6042, Karshi-8, Karshi-9, Surkhon-2, 3, 5, 7, 9, 14, 16, 18, 100, 101, 102, 103 of cotton [15]. At present, an acute environmental problem in the country – deficiency of irrigation water and creating drought-resistant varieties of fine-fiber cotton requires a broad research to find the physiological parameters of plant water metabolism in conjunction with the morphological characteristics of the leaf in different conditions of water deficiency.

Research methods

The aim of the research was carried out at the Institute of Genetics and Experimental Plant Biology at the Academy of Sciences in Uzbekistan. The soil was typically unsalted. As the objectives of research was new lines of fine-fiber cotton; - L-167, L-663, L-2006, L-5440, L-5445, L-450; use in hybridization of the thin-fiber ruderal subspecies ssp. vitifolium - L-1 and L-10, as well as varieties such as Surkhon-14, Termiz-31 and Marvarid, conducted by the scientists at the institute. Additionally, lines of fine-fiber and varieties of cotton were sown shortly in the experiment of lysimeter on two backgrounds of water regime: water supply and drought lands. Lines and varieties according to each background of the water regime were sown in three randomized repetitions, 10 plants in each repetition. Schema of sowing is 60 x25 x1. The water supply indicated the plants were determined simultaneously in both backgrounds, when the pre-irrigation soil moisture at an optimal water supply background was 70-72% of the water content (field moisture capacity), and according to the background of a simulated drought, it was 48 -50% from the water supply. Physiological parameters were determined according to the total water content in the leaves - according to M.D. Kushnirenko [16]; the intensity of leaf transpiration according to A.A. Ivanov [17]; water holding capacity of leaves - according to N.N. Tretyakov [18]. The collected data were statistically analyzed with the method of B.A. Armor [19] and ANOVA models. Adaptability of coefficient (Cad.) was calculated by the formula S.A. Ebarhart [20].

Results of research:

According to the analysis collected from the data indicated the water content of plant leaves ranged from 77.8% (L-2006) to 80.5% (Termez-31). In modeling drought, a research on the lines of fine-fiber and varieties of cotton, the trait indicated decreasing point - from 1.9% in the Termez-31 variety to 8.8% in the L-1 line. With a deficit of soil moisture, the greatest amount of water was observed in plants of the Termez-31-78.6% variety, and leaves of the L-1 line contained the least amount of water - 70.2% (Table 1).

Table1. Water content in the leaves such as lines and varieties of fine-fiber cotton in optimal water availability and modeling the drought:

№	Lines and varieties	Water content in the leaves %		Cad %	Difference %
		OWS	MD		
1	L-167	78,53±0,44	74,60±0,05	-5,0	3,9
2	Surxan-14	79,33±0,06	71,33±0,56	-10,1	8,0
3	L-663	78,23±0,26	74,23±0,17	-5,1	4,0
4	L-2006	77,83±0,41	74,76±0,60	-3,9	3,1
5	L-5440	79,43±0,08	73,26±0,03	-7,8	6,2
6	L-10	79,33±0,26	73,16±0,37	-7,8	6,2
7	L-1	78,96±0,51	70,2±0,63	-11,1	8,8

8	Termiz-31	80,50±0,10	78,6±0,43	-2,4	1,9
9	L-5445	79,03±0,20	73,33±0,44	-7,2	5,7
10	L-450	79,30±0,05	75,73±0,18	-4,5	3,6
11	Marvarid	79,30±0,51	73,30±0,30	-7,7	6,0

Note: OWS-optimal water supply; MD-modeling drough

The intensity of transpiration in the leaves; in optimal water regime, the transpiration rate proceeded most intensively in the leaves at the early ripening Marvarid and medium contained 356.77 mg H_2O / 1 gram of raw leaf x 1 hour. Lowest indicators in comparing late ripen lines as L-10 and L-2006, consequently, 149.04 mg H_2O / 1 gram of raw sheet x 1 hour and 156.56 mg H_2O / 1 gram of raw sheet x 1 hour (Table 2).

Having compared the data collected from the optimal background water with conditions of insufficient water availability, the transpiration rate decreased to different levels in all conducted lines and kinds of fine-fiber cotton (from 12.6% in Termez-31 to 43.9% and 42.2% in Marvarid and L-553 line). According to water deficiency, the highest leaf transpiration rate was observed in the Marvarid plants —200.26 mg H2O / 1 gram of raw leaf x 1 hour, whereas in the ripening L-10 and L- lines In 2006, as well as in the L-663 line, as it indicated the lowest and amounted to 106.45 mg, 109.19 mg and 111.03 mg H2O / 1 gram of raw leaf x 1 hour, respectively.

Table2. Intensity of transpiration in the leaves and varieties of fine-fiber cotton in optimal water supply and modeling the drought:

№	Lines and varieties	Intensity of transportation, мгH_2O/1г in the leaves x 1 hour		Cad, %	difference,%
		OWS	MD		
	L-167	245,3±9,0	147,5±1,3	-39,9	97,8
	L-663	192,1±3,7	111,0±0,4	-42,2	81,1
	Surkhan -14	263,3±4,0	176,5±4,9	-33,0	86,8
	L-2006	156,6±3,5	109,2±1,2	-30,3	47,4
	L-5440	200,2±2,2	134,5±1,7	-32,8	65,7
	L-10	149,0±0,3	106,5±3,1	-28,5	42,5
	L-1	224,1±0,5	161,2±2,6	-28,1	62,9
	Termiz-31	213,7±0,6	186,7±2,5	-12,6	27,0
	L-5445	181,3±2,3	126,6±2,2	-30,2	54,7
	L-450	230,3±0,5	179,0±1,2	-22,3	51,3
	Marvarid	356,8±5,1	200,3±5,5	-44,0	156,8

Note: OW-optimal water supply; MD-modeling the drought.

CONCLUSION

1. Soil moisture deficiency in research of lines and varieties of fine fiber cotton in the flourishing phase depending on individual genotype reaction in different levels decreases water content and transpiration in the leaves and improves water-holding capacity.

2. Water deficiency in the lines and varieties of fine fiber cotton decreases surface thickness of leaves and width, but the 3 rd leaf indicated physiological properties in the above-mentioned tables and diagrams, which showed transportation in the leaves and denying water deficiency. In such case, lines (L-10, L-450, L-2006) increased width of 3rd leaf and variety Termiz-31 decreased, other genotypes showed stability in different conditions of water availability.

3. Decreasing water content and intensity of transpiration in the leaves increases water-holding capacity and density surface of leaf is considered as a morpho-physiologic adaptation of lines and varieties of fine-fiber cotton to the conditions of water deficiency in the soil.

4. Water deficiency in the lines such as L-10, L-1, L-2006, L-5440, and also L-663 in the longer growing season, had high water-holding capacity in the leaves in the flourishing phase, which indicates the possibilities of their use in genetic-selection research according to the selection of fine-fiber cotton in drought conditions.

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