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Evaluation and Selection of Promising Collection Material with Naturally Dyed Fiber

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Abstract: The article presents the results of the analysis of the formation of the traits "staple length" and "yield" of the fiber of collection samples with naturally colored fiber, in order to involve the best in breeding aimed at creating varieties with naturally colored fiber. According to the results of the analysis, the best samples were selected:
- sample 02757 ssp.mexicanum beige fiber, staple fiber length 31.6 mm;
- sample 101105 dark brown fiber has an advantage in terms of "fiber output", where M = 36.9 ± 0.84; δ=3.39; V% = 9.17
- accessions 02757 and 101105 should be used in breeding cotton varieties with naturally colored fiber and combining high yield and staple fiber length.

Keywords: cotton, G.hirsutum. L, fiber, color, fiber length and output, sample, selection, selection

1. Introduction

Cotton is grown primarily for its fiber, but at the same time, in addition to textile products, more than 100 items of various products are produced from it [Avtonomov A.A., 1973]. In wild-growing species of cotton varieties, the fiber has not only white, but also green, brown color of various shades [Korenev et al., 1990].
In connection with the growth of the well-being of the population in the world, there is an increasing need for yarn and fabrics made from raw cotton varieties of cotton grown without the use of any pesticides and mineral fertilizers requirements for textile products. The strength and beauty of fabrics largely depend on the raw material (fiber). Therefore, breeders need to create the best cotton fiber, taking into account the specialization of various textile products. Based on this, breeders have now significantly expanded their activities, as previously [Korenev G.V. et al., 1990], and currently in countries such as China, Turkey, Uzbekistan, selection is being carried out aimed at creating cotton varieties with naturally colored fiber.
It is believed that cotton with naturally dyed fiber originated in the American Andes 5000 years ago as a result of a violation of the pigmentation process due to adverse climatic conditions [Ibragimov P.Sh., 2006]. Demand for naturally dyed fiber is growing day by day, while its production volumes are still not sufficient to meet the demand. It is known that the quality of natural-dyed fiber is inferior to white fiber. The creation and use of varieties with naturally dyed fiber makes it possible not to bleach and dye it, that is, not to use water. Drinking water used to dye fabrics is one of the main sources of soil and environmental pollution. Many of the chemicals used are carcinogenic and adversely affect human health [Kimsanbaev O.Kh., 2011; Korenev G.V. 1990].
In connection with the foregoing, the population of highly developed countries prefer textile products made from fabric made from naturally dyed fiber, as they do not contain chemically hazardous substances and organic fertilizers used both in the production of raw cotton and in textile production [Korenev G.V. ., 1990, Kimsanboev O.Kh., 2011].
In connection with the above, breeders of the leading cotton-growing countries of the world create varieties of cotton with naturally dyed fiber, combining high quality and quantity of fiber. Previous studies have established that the brown color of the fiber is superior to other colors, but at the same time, as a rule, the color of the fiber negatively correlates with the main economically valuable traits, which greatly complicates the selection and introduction of new competitive varieties into production [Maksimenko I.K., 1958 ; Namazov Sh., 2016; Straumal B.P., 1974.].
The low quality of dyed cotton fiber is difficult to overcome due to the complexity of the physiological and biochemical processes associated with the climatic conditions of cotton growth and fiber formation during the growing season, which greatly complicates the breeding process, but at the same time, the cultivation of cotton varieties with naturally dyed fiber combines high quality and the quantity exceeds economically varieties with white fiber [Zhao L., 2009].

The staple fiber length in cotton in nature varies from 10 to 50-55 mm [Murthy, M.S., 2001].
Yield and traits that determine fiber quality are the main traits that determine the profitability of cultivating a variety, which must be taken into account when breeding new varieties of cotton [Maximenko I.K., 1958; Korenev G.V., 1990.].
As you know, naturally dyed fiber during subsequent processing provides high resistance of dyed products to external influences [Korenev G.V., Podgorny P.I. et al. 1990.], while retaining all the qualities inherent in high-quality fiber.
Selection of cotton varieties with naturally colored fiber at the Central Breeding Station was started in 1937 by S.G. Badalov, and since 1939 this direction was led by B.P. 4086, C-4106 with the quality of type VI fiber [Maximenko I.K., 1958;] (1974).
Purpose of the study – evaluation and selection of the best collection samples with naturally colored fiber on the basis of "staple fiber length" and "fiber output", in order to be involved in the breeding process.

Research objectives: - evaluate and select among the collection samples of cotton involved in the experiment the best ones with naturally colored fiber;
- to establish the variability of the characteristics "staple fiber length" and "fiber output" in the collection samples involved in the experiment;
- to recommend the best collection samples with different fiber colors with high values of the traits "staple fiber length" and "fiber yield" in the breeding process.

2. Materials and Methods

In the period from 2014-2021, field studies were carried out with the participation of collection material with naturally dyed fiber, which was studied in the laboratory of "breeding cotton varieties resistant to abiotic environmental factors", under the guidance of Professor V.A. Avtonomov.
Experiments related to the evaluation and isolation of selection-significant collection samples were carried out in the field and in the Phytotron greenhouse complex of the Research Institute of Breeding, Seed Production and Agricultural Technology of Cotton Growing (NIISSAVKh), located in the Tashkent region, the Republic of Uzbekistan.
The temperature conditions of 2020-2021 during the field experiments turned out to be favorable. Sowing in the indicated period in the field was carried out on April 26 and 17, respectively, with 50% of seedlings obtained on May 6-7 and April 28-29 after the feeding irrigation. The plants developed at constantly rising temperatures, and the hot summer and warm autumn made it possible to complete the harvesting of seed raw cotton by September 20. Agrotechnical activities were carried out typical for this area of cotton cultivation.
Field experience and experience in the greenhouse complex "Phytotron" was laid in three repetitions, randomized blocks. For each sample, from 40 to 60 plants were studied. C-6524 with white fiber served as an indicator variety.
Harvesting of seed raw cotton was carried out at the optimal time, while the harvest in the form of individual selections was harvested from each previously labeled plant individually.
Variational-statistical processing of the results of the research was carried out according to the computer program SPSS.
The experiments were carried out with the participation of the following 8 collection samples - with different fiber colors: sample 017597 * - brown fiber; sample 02757*, ssp. mexicanum - light brown fiber; Sample 07223* Fiber Vente - Beige; sample Turkey brown - brown fiber; sample Turkey brown - fiber of light brown color; sample Turkey brown - dark brown fiber; sample Ankansas Greenlint - green fiber; sample 101105 - dark brown fiber.

3. Results And Discussion

Based on the analysis of the conducted field studies, which are presented in Table 1, it can be seen that the average value of the “staple fiber length” feature ranges from 27.7 mm for sample No. 101105 with dark brown fiber to 31.6 mm for sample No. 02757 with beige fiber. Whereas in the indicator variety S-6524, which has a white fiber, the average value of the analyzed trait is 34.4 mm. Analyzing the percentage of plants placed in classes with different fiber lengths, it can be seen that the total number of plants involved in the experiment is placed in 3-4 classes. At the same time, a certain number of plants are placed in a class with values from 34 to 36.9 mm, which is of interest from a breeding point of view.

TABLE 1. Variability of "staple length" and "fiber yield" features in collection specimens with naturally dyed

№	Variety -indicator №№ sample according to the RIBSPACG catalog	Fiber color	K=3.0 mm							K=3.0%					
			% plants with staple fiber length							% plants with fiber output					
			25-27.9	28-30.9	31-33.9	34-36.9	M±m	∂	V %	32-34.9	35-34.9	38-40.9	M±m	∂	V %
1	C-6524 (ind)	white			27.8	72.2	34.4 ±0.56	0.74	3.87	65.4	34.6		34.7 ±0.27	0.34	3.16
2	017597	brown	50.0	25.5	12.5	12.5	28,3 ±0,96	2,73	9,61	25.0	37.5	37.5	33,8 ±1,20	3,39	10,03
3	02757. ssp.mexicanum	beige		36.0	55.0	9.0	31,6 ±0,54	1,79	5,66	63.6	27.3	9.1	31,0 ±1,03	3,42	9,26
4	07223. Fibre Vente	beige	32.6	53.1	9.5	4.8	29,0 ±0,51	2,36	8,11	61.9	23.8	14.3	33,0 ±0,58	2,68	7,64
5	Turkey brown	brown	25.0	50.0	12.5	12.5	29,1 ±0,53	1,49	5,13	50.0	37.5	12.5	33,3 ±0,96	2,73	7,72
6	Turkey brown	beige	20.0	30.0	40.0	10.0	30,1 ±1,07	3,22	10,69	55.6	39.3	11.1	32,1 ±0,86	2,59	7,37
7	Turkey brown	dark brown	14.2	28.5	57.3		30,7 ±1,02	2,70	8,77	14.3	28.6	53.1	32,8 ±0,84	2,22	5,80
8	Arkansas Greenlint	green	44.5	33.4	22.2		28,8 ±1,07	3,22	11,18	55.6	33.3	11.1	35,1 ±0,86	2,59	7,37
9	101105	dark brown	41.7	50.0	8.3		27,7 ±0,82	2,83	10,19	8.3	25.0	66.7	36,9 ±0,98	3,39	9,17

As can be seen from Table 1, 72.2% of plants in the indicator variety C-6524 are placed in the class with values from 34 to 36.9 mm.

As can be seen from the analysis, the value of the standard deviation (∂) for collection samples with naturally colored fiber ranges from 1.79 for sample No. 02757 to 3.22 for samples No. Turkey brown with beige fiber color and Arkansas Greenlint with green fiber color, which indicates wide variability of the trait “staple fiber length”, while in the indicator variety S-6524 it is equal to 0.74.

As can be seen from the analysis of the placement of plants in the variation series and the values of the standard deviation, the range of variability of the trait is much wider, which is obviously associated with the photoperiodic response of plants.

Based on the foregoing, for further breeding elaboration by methods of analytical and synthetic breeding, it is recommended to use plants placed on the right side of the variation rows, such collection samples as No. 017597, 02757, 07223, Turkey brown with brown fiber, Turkey brown with beige fiber, in which, respectively there is a certain percentage of 12.5, 9, 4.8, 12.5 and 10.0 plants with the value of the trait "staple fiber length" ranging from 34 to 36.9%.

Based on the analysis of the conducted field studies, which are presented in Table 1, it can be seen that the average value of the “fiber yield” feature ranges from 31.0% for sample No. 02757 with beige fiber color to

36.9% for sample No. 10105 with dark brown fiber color. Whereas in the indicator variety S-6524, which has a white fiber, the average value of the analyzed trait is 34.7%.
Analyzing the percentage of plants placed in classes with different fiber yields, it can be seen that the total number of plants involved in the experiment is placed in 3 classes. At the same time, a certain number of plants are placed in the class with values from 38 to 40.9%, which is of interest from a breeding point of view. As can be seen from Table 1, 65.4% of plants in the indicator variety C-6524 are placed in the class with values from 32 to 34.9%.
As can be seen from the analysis, the value of the standard deviation (∂) for collection samples with naturally colored fiber ranges from 2.22 for sample Turkey-brown with dark brown fiber color to 3.42 for sample No. 02757 with beige fiber color, which indicates a wide variability of the "fiber yield" trait, while in the indicator variety C-6524 it is equal to 0.34.
As can be seen from the analysis of the distribution of rows in variational plants and the values of the standard deviation, the range of variability of the trait is much wider, which is obviously associated with the photoperiodic response of plants.
Based on the foregoing, it is recommended to use the plants placed on the right side of the variational rows for further selection study by methods of analytical and synthetic selection for all collection samples involved in the experiment with the values of the "fiber yield" trait from 38 to 40.9%.

4. Conclusion

Based on the analysis of the results of the conducted field studies, the following conclusions should be drawn:
Among the collection samples with naturally colored fiber involved in the experiment, one should single out sample no.
Sample No. 101105 with a dark brown fiber color has an average fiber yield of 36.9%.
Separate plants of samples according to Nos. 0 2757 and 101105 placed on the right side of the variation rows should be used in breeding varieties with naturally colored fiber of various colors.

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