Creation of selected items with high fiber yield and length based on cotton composite hybrids

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Abstract. The wide range of possibilities of using double, complex and double crossing methods in cotton has been studied in selection research. As a result of the use of complex hybridization, valuable traits of varieties of different genetic origin can be collected in a single genotype in a short period of time. Because in the hybrids created on the basis of complex cross-breeding, the variability of quantitative characters is manifested on a large scale, and the possibility of extensive selection appears in these hybrid populations. It is important to use various breeding methods in cotton selection, which are widely used in other agricultural crops. As a result of transgressive variation occurring in composite hybridization in cotton, the increase in the possibility of isolating recombinants, which are the source of new genetic variations, which gives the opportunity to create new varieties with a positive set of valuable economic characters in a short time, has been confirmed in the selection of other crops. In the article, it is stated that the correct selection of parental pairs and the use of composite hybridization method are important for the improvement of fiber yield and fiber length in the creation of new varieties of cotton. In particular, the effectiveness of using T-3377, T-3378, T-3379 varieties, created on the basis of composite hybridization, in achieving positive results in terms of fiber yield and fiber length was highlighted.

1 Introduction

In our republic, extensive measures are being taken to create new cotton varieties that are competitive, productive, and whose fiber quality meets the requirements of the world cotton market [1-4]. As a result, valuable breeding materials are created that are resistant to germs, water shortages, insects and pests and other factors. In this regard, it is important to expand scientific research works on the creation and introduction into production of new selected varieties of agricultural crops that are resistant to diseases and pests, suitable for soil and climate conditions [5-9].

In order to solve these problems on a global scale, it is important to use various breeding

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methods in cotton selection, which are widely used in other agricultural crops. As a result of transgressive variation occurring in composite hybridization in cotton, the increase in the possibility of isolating recombinants, which are the source of new genetic variations, which gives the opportunity to create new varieties with a positive set of valuable economic characters in a short time, has been confirmed in the selection of other crops [8-11]. In this case, the probability of achieving a high level of success does not increase with the complexity of the breeding methods, but the parental varieties are carefully selected for a certain positive character, and the efficiency of the targeted genes increases. Considering the above, the topic of this work is aimed at bringing out the full effect of composite breeding [12-15].

The purpose of this work is to create high-yielding, early, high fiber quality and yield, resistant to some diseases starting materials for practical selection by means of composite hybridization in medium fiber cotton. A lot of research has been carried out on the use of backcross, stepwise complex and other hybridization methods in foza breeding. The possibilities of using convergent, double and complex crossing methods in cotton have been studied in some studies. Most of the conducted studies have recognized the possibilities of obtaining recombinants with wide genetic variability and creating starting material with valuable economic characters for selection through the method of double crossing [1-5, 9].

The wide range of possibilities of using double, complex and double crossing methods in cotton has been studied in selection research. As a result of the use of complex hybridization, valuable traits of varieties of different genetic origin can be collected in a single genotype in a short period of time. Because in the hybrids created on the basis of complex cross-breeding, the variability of quantitative characters is manifested on a large scale, and the possibility of extensive selection appears in these hybrid populations [1-7].

According to Kholmurodova and Namozov [2], they showed that the heredity of fiber output in F1 hybrids and the formation of F2 hybrids depend more on paternal varieties, and therefore, it is advisable to use varieties with high fiber output as paternity in crossbreeding. According to them [2], due to weak transgression in the F2 generation of fiber length hybrids, selections for the character should be carried out in subsequent generations. S-6532 and Tashkent-6 can be used to obtain hybrids with yield and fiber length, and Tashkent-6 and VNIISSX-1 varieties can be used to obtain recombinants with large seeds.

Fiber length and thinness and high fiber yield in the thin-fiber Ashgabad-25 variety are controlled by recessive genes. This means that when this variety is used in hybridization, selection work on these characters should be carried out in higher generations, taking into account their genetic nature [1-7, 11]. Therefore, they noted that in the next generations of plants located in the middle of the range of variation, valuable transgressive forms appear in terms of fiber quality and yield.

The new convergent breeding method is highly effective in obtaining recombinant cotton plants with valuable complex economic traits and using them as the main starting source for the selection process [4]. It was also observed that most of the isolated convergent families were superior to the model varieties in terms of valuable economic characteristics (fiber yield, fiber length, disease resistance), and some were equal to the model variety [5]. As a result of comparative observations and analysis of the morphological characteristics of the high-generation convergent hybrids, the superiority of convergent hybrids in improving valuable economic characters was confirmed. It should be noted that as a result of convergent hybridization, wilt tolerance is high in varieties [11].

In breeding, complex cross-breeding also plays an important role and is one of the sources of creating genetic diversity and improving agricultural crops. In the hybrids obtained with the participation of medium-fiber varieties of different types obtained by complex hybridization, the inheritance of the fiber length character depends on the genotype of the maternal variety, and Bekzhanov et al. showed that it is possible to separate recombinants specific to thin-fiber cotton varieties by complex hybridization in terms of fiber length. [6] noted. Also, it has been proved that in the F1 generation of complex hybrids, compared to simple hybridization, drastic improvement can be achieved in other economic traits.

Also, a number of scientists have given information in their research on the effectiveness of complex hybridization from different hybridization methods [7-10, 12].

Kimsanbaev [14] studied the correlation between fiber length and fiber yield, cotton weight in 1 boll, yield of one plant, length of vegetation period, location height of the first harvest branch in F2 hybrids of cotton, and found that there is no moderate or strong correlation between them.

According to Boboev and Togaev, fiber length is more positive in interspecific hybrids, due to the fact that several species that are sharply different from each other participated in the crossbreeding, and this caused the separation process in a wide range of fiber length, which made it possible to isolate long-fiber recombinants from among them. creates [15].

The data of Namazov and Boboev show the effectiveness of breeding material obtained by interspecies hybridization [16]. Currently, the Sultan and Jarkurgan varieties, which are cultivated in large areas of our republic, were created through cross-species hybridization.

Based on the results obtained on the length of the fiber, it was confirmed that it is possible to achieve a positive variation in character by complex and backcross hybridization. In complex and backcross hybridization, it was found that recombinants with relatively high fiber length appear mainly from the G'3 generation, and in order to improve the average index of the fiber length marker in the upper generations of hybrids, it is better to involve forms with a relatively high index in the crossbreeding.

They showed that the heredity of fiber output in F1 hybrids and its formation in F2 hybrids depend more on paternal varieties, and therefore, it is advisable to use varieties with high fiber output as fathers in crossbreeding. According to them [1-7], due to weak transgression in the F2 generation of fiber length hybrids, selections for the character should be carried out in subsequent generations. S-6532 and Tashkent-6 can be used to obtain hybrids with yield and fiber length, and Tashkent-6 and VNIISSX-1 varieties can be used to obtain recombinants with large seeds.

Improving the quality of fiber has always been the main task. At the same time, there are some problems in creating varieties with sertola and high quality. First, there is a negative correlation between fiber yield and quality [15]. There are strong negative correlations between fiber yield and fiber quality. Negative correlations were found between yield and some fiber quality traits, especially fiber length and maturity and fiber yield were negatively correlated. Fiber maturity was found to be positively associated with yield. It was found that micronour and fiber softness were not associated with yield. Weak ties can be broken through individual choice exercises. This work should start in the younger generations. Genes controlling fiber quality traits show their additive effect in the F5–F6 generation. Another factor that reduces fiber quality is leaf residue, as contamination is high in deciduous plants during machine harvesting. Dramatically reducing leaf hairs reduces fiber contamination.

Polyploidization, i.e. doubling the number of chromosomes, in the hybrids of the Sakel variety of the G. barbadense L. species with the New World G. trilobum wild type, as a result of recrossing, fiber maturity is 25.0-30.0% higher than the parental forms. in the central region of tropical plant science in Belgium, based on backcrossing of AD1 (G.hirsutum L.), D1(G.thurberi Tod.) or D5 (G.raimondii) with G.hirsutum L. stated that hybrids were obtained. A. In the work of Abdullaev and others, many works were carried out on the enrichment of the cotton genotype, including the ability of cotton species belonging to different genomes to hybridize with each other, the affinity between them, and the involvement of different cotton genomes in genetic-selection studies, and positive results were obtained. As a result of colchicine treatment of F1G.hirsutum x G.australe (2n = 3x = 39) hybrid combination, allohexaploid (2n = 6x = 78) was obtained and it was noted that useful genes of G.hirsutum and G.australe species can be transferred by backcrossing. By crossing the Australian Carmen and Flora varieties with the local Namangan-77 and Namangan-34 varieties, a group of varieties was created that was resistant to wilt disease, had a high fiber yield, and was superior to the model variety in terms of the number and size of pods. As a result of individual selection, in the third generation, genotypes were selected that combined the fast ripening characteristic of Uzbekistan varieties with the fiber yield and fiber index of Australian samples. In the research conducted, the Australian cultivars Carmen and Flora were studied in comparison with the model variety Namangan-77. Researches were carried out in the field according to the method of the state variety testing commission, and plant height, number of sympodial branches and bolls, ripening date, yield, productivity, seedling thickness, vegetation period, cotton weight per boll, fiber length, first (15.09), second (25.09) skin, total skin and fiber output were determined. In terms of plant height, foreign varieties were 12-15 cm lower than the standard variety. The number of sympodial branches was almost the same as that of the Namangan 77 variety, and it was noted that the number of pods was 2.5 less. In addition, the vegetation period was extended by 10-14 days in Carmen and Flora varieties. Productivity was higher in foreign varieties by 1-5 ts/ha, and at the same time productivity increased by 1.7g. In this experiment, the researchers also studied options with different seedling thicknesses. Varieties were studied at the thickness of 90,100 and 110 thousand seedlings per hectare. Irrigation was carried out in the 1-2-1 system. The highest productivity was observed at a thickness of 90-100 thousand seedlings. Foreign varieties Carmen and Flora showed a higher yield by 2.5-3.0 t/ha compared to the standard variety Namangan-77. In terms of fiber output, they were superior by 3-5%. There was no significant difference in yield in varieties with 100,000 bushels/ha and 110,000 bushels/ha.

These researchers recommend involving Carmen and Flora varieties in the selection process for fiber quality and yield. The most studied of the Australian wild species is G.sturtii. Based on the researches, this species easily crosses with American D and AD1, AD2 genomes, very difficult crossing with Afro-Asian and Indo-Chinese species G.arboreum L and G.herbaceum L, G.aridum (D-genome) and G.stocksii (E-genome) and it was found that it does not cross at all with the species. The vigor and high sterility of the first generation hybrids were shown in all crossbreedings. Geneticists and breeders have been paying a lot of attention to Australian cotton species in the last 10-15 years. In many genetic and selection studies, many selection materials were created using Australian samples, which are quick-ripening, high-yielding, naturally shedding leaves, resistant to water scarcity, cold temperatures and some sucking insects [1-8].

As a result of the use of complex hybridization, in particular, composite hybridization, it is possible to collect valuable traits of varieties of different genetic origins in a single genotype in a short period of time. Because in the hybrids created on the basis of complex cross-breeding, the variability of quantitative characters is manifested on a large scale, and the possibility of extensive selection appears in these hybrid populations.

2 Materials and methods

As the object of the research, the varieties of cotton G. hirsutum L. Sultan, Jarkurgan, L-151, Gulistan, Tashkent-6 and Bukhara-6 and their hybrids were used.

The subject of the research is to determine the transgression of the signs in the sources obtained in the double and composite breeding methods and the correlation between the valuable economic signs of the hybrids in the hybrids.

Analysis of hybridization, single selection and inheritance of traits from generation to generation, laboratory and field experiments. The obtained results were subjected to statistical analysis according to the method of Dospekhov [5].

3 Results and discussion

It is known that the fiber output is considered as one of the main polygenic traits, and today the fiber output is required to be no less than 38-40%. Parental genotypes of hybrids are also important in improving the trait. In our research, the type IV variety of medium-fiber cotton "Jharkurgan", involved in crossbreeding as parental forms, was created from a complex interspecies hybrid F10[(F1 G.thurberi Tod. x G.raimondii Ulbr.) x LTsG-187] based on multiple selection. Entered into the State Register in 2013. The ripening time is 120-125 days. The bush is cone-shaped, 1-2 types of branching, height 140-150 cm. The stem is strong, moderately hairy, does not tend to lie down. The leaf is 3-5 lobed, medium in size, the first crop branch is formed in 6-7 joints. Bolls - weight of cotton in one boll is 6.0-6.5 g, weight of 1000 seeds is 135-140 g, fiber yield is 36.0-38.0%, fiber quality belongs to type IV: micron 4.5-4.7 , fiber length (UHML) of 1.20-1.25 inches, relative breaking strength of 33.0-34.0 g.s/tex is considered a variety that incorporates high indicators.

The cotton variety "Sultan" was created at the Scientific-Research Institute of Cotton Selection and Seed Breeding of Uzbekistan based on the selection of F5(F1 G.thurberi Tod. x G.raimondii Ulbr.) x Acala sj-5 from a complex interspecies hybrid. Entered into the State Register in 2011. The ripening time is 115-120 days. The bush is cone-shaped, branching type 1, height 130-140 cm. The stem is sparsely hairy, strong, does not tend to lie down. The structure of the leaf is claw-like, medium in size, the first crop branch is formed in the 6-7 joint of the bush. Bolls are 4-5, cotton weight in one boll is 6.0-6.5 g, weight of 1000 seeds is 130-135 g, fiber yield is 34-35%, fiber quality belongs to V-type: micronaire - 4.5-4, 6, fiber length (UHML) 1.12-1.15 inches, relative breaking strength - 26.4 gs/tex.

The salt-resistant cotton variety "Guliston" was created at the Institute of Agrotechnologies of Cotton Selection, Seed Breeding and Cultivation. In 2016, it was recognized as promising and included in the State Register of Syrdarya region. Guliston variety was created by multiple single selection from hybrid combination {F1 (Acala 1517-70 x Yucatanense) x S.Compositae}. The height of Gulistan variety of large-boiled cotton, resistant to water shortage and salt, is 100.0-125.0 cm. The first harvest branches appear in 5-6 joints. Wilt resistant. The industrial type of fiber is IV, the color of the fiber is white, the yield is 37.5-38.5%, the length is 1.17-1.21 inches, the breaking length of the fiber is 30-35.5 g.k/tex. 1000 seeds weigh 125.0-130.0 g, have thick gray hairs. Productivity is 40.0-45.0 ts/ha when maintained under high agrotechnical conditions.

The L-151 line of water-deficit and salt-tolerant cotton was created at the Institute of Agrotechnology of Cotton Breeding, Seeding and Cultivation. Plant height 100.0-125.0 cm, first crop branches in 6 joints, fiber color white, fiber yield 37.5-38.5 percent, fiber length 1.17-1.21 inches, fiber break length 30.0 -35.5 g.k./tex, the weight of 1000 seeds is 125.0-130.0 g, with thick gray hairs, the yield is 40.0-45.0 ts/ha when maintained under high agrotechnical conditions, fiber IV industrial type gives a complete answer.

It was created at the Research Institute of Plant Experimental Biology of the Tashkent-6 Academy of Sciences. The vegetation period is 113-117 days, the average yield of cotton raw materials is 32.8-38.0 t/ha, the weight of cotton in one boll is 4.7-5.7 g, the weight of 1000 seeds is 115 g, the fiber yield is 35.6- 36.3%, Fiber quality parameters according to

Quality Center: micron 4.4-4.8, fiber length (by HVI system) 1.09-1.15 inches, fiber length 35-37 mm, specific breaking strength 27.4 -30.0 gs/tex.

We have created double and composite hybrids based on the above varieties. Based on selections among hybrid combinations, families were separated and lines were created.

According to Table 1, the fiber yield of families obtained on the basis of pair hybridization was 38.9% (O-27) to 39.7% (O-31). In general, fiber yield was higher than 39% in almost all of these families, 39.6%, 39.3%, and 39.1% in O-25, O-26, and O-28 families, respectively. In the families obtained on the basis of pair hybridization, the mean square deviation was from 2.0 (O-31) to 3.80 (O-27), and the amplitude of variation was from 5.20% to 7%. The isolated families of this block showed a superiority of 2.9% (O-28) to 3.5% (O-31) compared to the model variety S-6524 (36.2%).

In the families obtained on the basis of composite hybridization, the index of fiber yield was from 39% (O-3407) to 42.4% (O-3406), and it was shown that the indicator of the index was mostly higher than 40% in these families. O-2757 family 42.2 %, family O-3411 was 42.1 % and family O-3398 was 40.9 %. It was observed that the root mean square deviation ranged from 1.61 to 3.17, and the amplitude of variation ranged from 4.30 % (O-2757) to 5.60 % (O-3406) in the families obtained on the basis of composite hybridization. In the families obtained on the basis of composite hybridization, superiority was observed from 2.8% (O-3407) to 6.2% (O-3406) compared to the model variety S-6524 (36.2%).

The yield of fiber in the varieties created on the basis of composite hybridization was higher than 41%, it was 42.8% in the T-3378 ridge, 42.4% in the T-3379 ridge, and 41.8% in the T-3377 ridge.

Table 1. Indicators of fiber yield in families and lines based on cotton double and composite hybrids

Family	Origin of families	Fiber output, %		
		M±m	δ	V, %
Families obtained on the basis of pair hybridization				
O-28	F4 Jarkurgan x Gulistan	39.1±0.6	2.52	6.42
O-27	F4 Jarkurgan x L-151	38.9±0.86	3.80	7.00
O-25	F4 Sultan x Gulistan	39.6±1.05	2.80	6.50
O-26	F4 Sultan x L-151	39.3±1.70	2.08	6.75
O-31	F4 Tashkent-6 x Bukhara-6	39.7±0.40	2.00	5.20
Композит дурагайлаш асосида олинган оилалар				
O-3411	F4 Jarkurgan x (F1 Jarkurgan x Gulistan)	42.1±0.70	1.82	5.40
O-2757	F4 Jarkurgan x (F1 Jarkurgan x L-151)	42.2±0.90	1.61	4.30
O-3398	F4 Jarkurgan x (F1 Sultan x Gulistan)	40.9±0.45	2.70	4.45
O-3407	F4 (Jarkurgan x (F1 Sultan x L-151)	39.0±0.60	2.73	5.30
O-3406	F4 (Jarkurgan x (F1 Tashkent-6 x Bukhara-6)	42.4±1.14	3.17	5.60
Created varieties				
T-3377	O-3398	41.8±0.75	1.70	3,30
T-3378	O-3406	42.8±1.42	1.18	3,60
T-3379	O-3411	42.4±0.64	1.57	3,53
C-6524 (St)		36,2±0,39	0.79	2.25

The average arithmetic deviation of the created varieties is from 1.18 to 1.70, and the amplitude of variation is from 3.30% to 3.60%, which indicates that the varieties are aligned according to the sign. In the created varieties, an advantage was noted from 5.6% (T-3377) to 6.6% (T-3378) compared to the model S-6524 variety. In general, proper selection of parental pairs and use of composite hybridization technique are important in improving fiber yield. According to Table 2, along with fiber yield, fiber length also showed a positive result.

Table 2. Fiber length indicators in families and varieties based on cotton double and composite hybrids

Family	Origin of families	Fiber length, mm		
		M±m	δ	V, %
Families obtained on the basis of pair hybridization				
O-28	F4 Jarkurgan x Gulistan	33.6±0.63	1.1	3,3
O-27	F4 Jarkurgan x L-151	34.7±0.52	1.04	3,0
O-25	F4 Sultan x Gulistan	33.2±0.40	1.14	3,4
O-26	F4 Sultan x L-151	33.4±0.58	1.84	4,5
O-31	F4 Tashkent-6 x Bukhara-6	34.8±0.48	1.29	3,7
Families derived from composite hybridization				
O-3411	F4 Jarkurgan x (F1 Jarkurgan x Gulistan)	34.3±0.58	1.7	3,8
O-2757	F4 Jarkurgan x (F1 Jarkurgan x L-151)	34.8±0.48	1.29	2,7
O-3398	F4 Jarkurgan x (F1 Sultan x Gulistan)	34.7±0.22	1.2	3,5
O-3407	F4 Jarkurgan x (F1 Sultan x L-151)	34.7±0.52	1.04	3,0
O-3406	F4 Jarkurgan x (F1 Tashkent-6 x Bukhara-6)	36.2±0.70	0.9	2,7
Created varieties				
T-3377	O-3398	36.0±0.68	1.2	3,2
T-3378	O-3406	35.5±0.32	0.8	1,9
T-3379	O-3411	36.2±0.75	1.8	3,1
C-6524 (St)		32,6±0,77	1.35	4.0

By nature, fiber output and fiber length are inversely correlated. But in our experiments, positive results were achieved for both signs. This definitely indicates that the characters are formed depending on the parental genotypes. In the families obtained on the basis of pair hybridization, the fiber length was 33.2 mm (O-25) to 34.8 mm (O-31). It was 34.7 mm in the O-27 family, 33.6 mm in the O-28 family, and 33.4 mm in the O-26 family. In this block families, the average arithmetic deviation was from 1.04 to 1.84, and the amplitude of variation was from 3% to 4.5%. While the average indicator of the model variety S-6524 was 33.6 mm, the superiority of the families based on pair hybridization from 0.6 mm (O-25) to 2.5 mm (O-31) over the model variety was noted.

In the families obtained on the basis of composite hybridization, the fiber length was from 34.3 (O-3411) mm to 36.2 (O-3406) mm. 34.8 mm in the family, 34.7 mm in the O-3398 family, 34.7 mm in the O-3407 family). It was noted that the average arithmetic deviation was from 0.9 (O-3406) to 1.29 (O-2757), and the amplitude of variation was from 2.7 % (O-3406) to 3.8 % (O-3411).

The fiber length of the created varieties was 36.2 mm in the T-3379 ridge, 36 mm in the T-3377 ridge and 35.5 mm in the T-3378 ridge, showing a high superiority in terms of character. It was noted that the arithmetic mean deviation was from 0.8 (T-3378) to 1.8 (T-3379), and the amplitude of variation was from 1.9 % (T-3378) to 3.2 % (T-3377). Compared to the created varieties model S-6524 (32.6 mm), an advantage was noted from 2.9 mm (T-3378) to 3.6 mm (T-3379), respectively.

4 Conclusions

The correct selection of parental pairs and the use of composite hybridization are important in creating new varieties of cotton. It is especially effective to use T-3377, T-3378, T-3379 varieties created on the basis of composite hybridization as starting materials for achieving high fiber output and fiber length.

It was found that the average arithmetic deviation of the created varieties was from 1.18 to 1.70, and the amplitude of variation is from 3.30% to 3.60%, which indicates that the varieties are aligned according to the sign. In the created varieties, an advantage was noted from 5.6% (T-3377) to 6.6% (T-3378) compared to the model S-6524 variety.

In the families obtained on the basis of composite hybridization, the fiber length was from 34.3 (O-3411) mm to 36.2 (O-3406) mm. 34.8 mm in the family, 34.7 mm in the O-3398 family, 34.7 mm in the O-3407 family). It was noted that the average arithmetic deviation was from 0.9 (O-3406) to 1.29 (O-2757), and the amplitude of variation was from 2.7 % (O-3406) to 3.8 % (O-3411).

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