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HEREDITY OF FIBER YIELD IN THE F1-F3 HYBRIDS CREATED INVOLVING INTROGRESSIVE COTTON RIDGES

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ABSTRACT

The article highlights the obtained results on the heredity of fiber yield in F1-F3 hybrids developed by cross-breeding of the Sultan variety included in the State Register of Agricultural Crops with new introgressive cotton ridges created by various complex hybridization methods.

KEYWORDS: Complex hybrids, introgressive ridge, fiber yield, heredity, dominance coefficient, variational analysis.

1. INTRODUCTION

Tasks to expand scientific research on the creation and introduction into production of new selection varieties of agricultural crops resistant to diseases and pests, adapted to local soil-climatic and environmental conditions were set in Paragraph 3.3 of the Decree of the President of the Republic of Uzbekistan dated February 7, 2017 PF-4947 "On the Action Strategy for further development of the Republic of Uzbekistan". In particular, in the cotton sector, which is the leading agricultural sector in Uzbekistan, the development of selection of cotton varieties that meet the above requirements, high fiber yield and quality is planned for the fall.

It is known that cotton is grown in 84 countries, including 20 in North and South America, 28 in Asia and Oceania, 31 in Africa, 3 in Europe (9 years ago it was 9) and Australia.

The leaders countries on the cultivation of cotton fiber are The People's Republic of China (9.0 million tons), India (6.6 million tons), the United States (2.8 million tons), Pakistan (2.1 million tons), Brazil (1, 7 million tons), Uzbekistan (0.94 million tons).

Based on the long-term analysis, it can be seen that the fiber yield of regionalized cotton varieties in the Republic in 1990 was 30.8%, and in 2015, this figure was 33.2%.[10] However, there is an urgent need to strengthen research to achieve high economic efficiency in cotton growing by ensuring a higher fiber yield of cotton varieties introduced into production.

In cotton growing, along with fast-growing varieties, the issue of creating high-yielding varieties and increasing productivity through selection without expanding the area under cultivation also plays a key role. It should be noted that studies on the genetic study of the mark of cotton yield have been carried out rapidly and are still being carried out[8,11,12,13,14,16] Patel G.B. and Patel C.T. In the experiments of Patel G.B. and Patel C.T, they noted that in cotton, productivity and fiber quality traits are controlled by several genes.[15]

Much research has been done on obtaining hybrids of cotton fiber quality trait heredity, with traits that are useful for production, by mixing genetically distant wild, semi-wild species with cultivars, and using them in the creation of new varieties[1,3,9,17,18]

It is known that the positive outcome of the selection of new cotton varieties depends on the genotype of the starting materials selected for crossbreeding. The hybridization methods used in the studies have shown that the varieties created remain genetically homogeneous, the variability of the characters decreases, the risk of epiphytosis increases and the overall productivity decreases.[2] In addition, it has been recognized by many scientists that most valuable economic traits can be improved by using interspecific and ecological-geographical and genetic long-term hybridization methods in cotton selection.[4,5,6] Therefore, various studies focus on the identification of specimens with donor characteristics, the study of the laws of heredity and variability, as well as the study of the processes of character formation in interspecific hybrids[4,5,7]

Based on the above, it is urgent to increase fiber yield through the use of new introgressive cotton ridges created by interspecific hybridization in the selection process in the creation of high-value cotton products for the main farm.

2. MATERIALS AND METHODS

Our research was conducted in 2017-2019 at the Scientific Research Institute of Seed and Cultivation Agrotechnologies of Cotton Breeding. The object of research is F_1-F_3 hybrids created by cross-breeding intra-species and inter-genomic introgressive cotton ridges with regionalized Sultan variety, such as F_{31} K-203 × Namangan-1, F_{16} K 58 × G.arboreum, F_{31} K-69 × *G.arboreum*, F_{24} Namangan-1 × Surkhan-5, L- 138, L-470/1, L-95, L-158, L-200, MVG-2, L-58, L-1979, L-175/248, L-12/06, F_{23} K-58 × G.arboreum, VSG-2/06, L-588 F1-F3 that were created in the laboratory "Cotton Genetics and Cytology" were used. The results of the study were analyzed by B.A. Dospekhov (1985) method.[3]

3. RESULTS AND DISCUSSION

The average fiber yield in the starting materials involved in the creation of these hybrids ranged from 35.3% (type F_{23} K-58 arb) to 40.8% (type F_{16} K-58 arb). All introgressive cotton ridges involved as a starting material showed an advantage in fiber yield over the C-6524 sort obtained as the standard variety (Table 1). In the parent material, the variance index of the mark (σ) was found to be 0.97 (F_{23} K-58 type arb) to 3.25 (L-12/06). Among the studied ridges, relatively high dispersion coefficients were observed in the L-12/06 (3.25), L-175/248 (3.12), and BSG-2/06 (3.02) ridges. It was found that the degree of variability of the starting materials ranged from 2.88% (L-588) to 8.22% (L-12/06), i.e., these ridges were relatively stable in terms of fiber yield.

The results obtained on the inheritance of fiber yield in F_1 hybrids involving introgressive cotton ridges and Sultan cotton variety are presented in Table 1. Based on the data presented in the table, it can be seen that the average character index in F_1 hybrids ranged from 37.2% to 42.2%. It should be noted that all of the F1 hybrids in terms of fiber yield had a higher performance than the Sultan cotton sort, which participated as a father. In particular, F_1 (F_{31} K-69 type arb) x Sultan (42.2%), F_1 (F_{16} K-58 type arb) × Sultan (41.5%), F_1 (F_{24} Namangan-1 × Surkhan-5) × Sultan (41.3%) combinations had a higher rate of fiber yield than other hybrids.

Dominance indices of fiber yield showed different character inheritance in F1 hybrids. That is, 9 of the studied hybrids were found to have heterosis-type inheritance in 9 combinations of intermediate and the remaining 8 hybrids.

Table 1: Inheritance of fiber output in F_1 hybrids involving the Sultan cotton variety.

No.	Combination	F_1 hybrid		
		M±m	V%	hp
1	F_{32}K203 × Namangan-1 × Sultan	37,8±0,89	5,29	1,44
2	F_{16}K58 type arb × Sultan	41,5±1,15	6,22	1,27
3	(F_{31}K69 type arb) × Sultan	42,2±0,72	6,86	2,56
4	(F_{24}Namangan-1 × Surxon-5) × Sultan	41,3±1,22	6,63	1,65
5	L-138 × Sultan	39,6±0,89	5,04	0,60
6	L-470/1 × Sultan	40,5±1,27	7,02	1,19
7	L-95 × Sultan	37,4±1,33	7,99	0,12
8	L-158 × Sultan	38,3±1,08	6,32	0,74
9	L-200 × Sultan	38,4±1,12	6,53	1,23
10	**MVG-2 × Sultan**	**38,5±1,19**	**6,91**	**0,70**
11	L-58 × Sultan	37,2±1,13	6,84	0,41
12	L-1979 × Sultan	38,5±1,72	10,01	0,76
13	**L-175/248 × Sultan**	**38,4±1,61**	**9,42**	**0,70**
14	L-12/06 × Sultan	38,3±1,24	7,25	0,35
15	(F_{23}K-58 type arb) × Sultan	38,4±1,08	6,33	15
16	**BSG-2/06 × Sultan**	**37,5±1,38**	**8,28**	**0,26**
17	L-588 × Sultan	38,2±0,87	5,11	1,45
18	Sultan	35,6±1,01	2,26	3,73
19	F_{32}K-203 × Namangan-1	37,4±1,92	1,30	4,50
20	F_{16}K-58 type arb	40,8±1,13	2,53	6,21
21	F_{31}K-69 type arb	39,3±1,28	2,88	7,31
22	F_{24}Namangan-1 × Surxon-5	39,9±2,72	2,08	5,24
23	L-138	40,6±1,28	2,87	7,27
24	L-470/1	40,1±0,52	1,17	2,90

25	L-95	38,8±1,00	2,24	5,77
26	L-158	38,7±1,15	2,58	6,64
27	L-200	38,1±0,87	1,97	5,15
28	MVG-2	39,0±1,13	2,54	6,51
29	L-58	37,9±0,93	2,09	5,51
30	L-1979	38,9±0,66	1,49	3,81
31	L-175/248	38,9±1,39	3,12	8,01
32	L-12/06	39,6±1,45	3,25	8,22
33	F_{23}K-58 type arb	35,3±0,43	0,97	2,74
34	BSG-2/06	38,6±1,35	3,02	7,83
35	L-588	37,7±0,48	1,09	2,88
36	C-6524 (Pattern)	34,6±1,31	1,15	1,78

Our researches on the study of the inheritance of fiber yield in F_2 generation hybrids involving the Sultan cotton variety showed that the mean marker ranged from 31.9% to 38.9% (Table 2). Among the hybrids of this generation, the relatively high results in terms of average fiber yield were observed in hybrids F_2 L-175/248 ×Sultan (38.9%), F_2 (F_{23}K-58 type arb) x Sultan (38.8%), F_2MVG-2 × Sultan (37.4%), BSG-2/06 × Sultan (37.2%) and L-1979 × Sultan (36.9%). Relatively low rates were lower in hybrids F_2L-470/1 × Sultan (31.9%), F_2 (F_{31}K-69 type arb) x Sultan (33.2%) in terms of fiber yield inheritance. The variance index was found to be between 8.9% (F_2 (F_{23}K-58 type arb) x Sultan) and 18.90% (F_2L-12/06 × Sultan). The relatively high variance rates in most F_2 hybrids created with the participation of introgressive cotton ridges indicate that the separation process is over a wide range.

Table 2: Variational changeableness of F_2 hybrids involving the Sultan cotton variety on fiber yield.

№	Hybrid combinations	n	К = 2,0										M±m	S	V,%
			25,1-27,0	27,1-29,0	29,1-31,0	31,1-33,0	33,1-35,0	35,1-37,0	37,1-39,0	39,1-41,0	41,1-43,0	43,1-45,0			
1.	F_2(F_{32}K203 × Namangan-1) x Sultan	60	3		3	7	14	18	8	2	1	4	35,2±1,20	4,51	12,81
2.	F_2(F_{16}K58 type arb) × Sultan	78	2	8	1	5	8	15	25	10		4	37,9±1,13	4,24	11,16
3.	F_2(F_{31}K69 type arb) × Sultan	48	1		7	2	7	16	10	2	2	1	36,8±0,97	3,65	9,92
4.	F_2(F_{24}Namangan-1 × Surxon-5) × Sultan	60		2	1		4	3	20	22	8		39,4±0,60	2,27	5,74
5.	F_2L-138 × Sultan	66		1	4	6	3	4	17	25	2	4	39,4±0,52	1,98	5,03
6.	F_2L-470/1 × Sultan	57	2	2		3	4	11	15	12	6	1	38,9±0,63	2,37	6,09
7.	F_2L-95 × Sultan	46		1	1	5	2	8	17	10		2	38,5±0,54	2,03	5,26
8.	F_2L-158 × Sultan	38	3	5		5	14	7		2		2	34,9±0,93	3,51	10,05
9.	F_2L-200 × Sultan	73	2	4		5	2	12	26	14	3	5	37,6±0,85	3,20	8,50
10.	F_2MVG-2 x Sultan	84	3	4	7	5	2	14	22	17		10	37,4±0,92	3,48	9,29
11.	F_2L-58 × Sultan	88		7	5		12	33	16	7	3	5	36,2±1,00	3,75	10,35
12.	F_2L-1979 x Sultan	64	3	1	2		10	30	9	6		3	36,0±0,77	2,91	8,07
13.	F_2L-175/248 × Sultan	52		4		4	3	7	20	6	3	5	37,6±0,94	3,54	9,42
14.	F_2L-12/06 × Sultan	56		3	3		8	4	17	9	7	5	37,7±0,88	3,29	8,72
15.	F_2(F_{23}K-58 type arb) × Sultan	47	2		1	3	6	20	10	3		1	36,3±0,56	2,11	5,82
16.	F_2BSG-2/06 × Sultan	55	3	5			3	12	19	9	3	2	38,4±1,19	4,49	11,66
17.	F_2L-588 × Sultan	63		3	2	9	7	27	5	9	1	1	35,5±0,87	3,27	9,19

The results of our research showed that the heredity of fiber yield in F3 hybrids with the participation of the Sultan cotton variety ranged from 34.9% to 39.4% (Table 3). In terms of fiber yield, almost all F_3 hybrids had a higher rate than the Sultan cotton sort, which participated as a father. In particular, F_3 (F_{24} Namangan-1 x Surkhan-5) × Sultan (39.4 ± 0.60), F_3L-138 x Sultan (39.4 ± 0.52) and F_3L-470/1 × Sultan (38.9 ± 0.63) hybrids have a relatively high performance and are distinguished from other hybrids. At the same time, F_3L-158 × Sultan (34.9 ± 0.93) and F3L-588 x Sultan (35.5 ± 0.87) hybrids had low rates of heredity of fiber.

In this generation, as in the F_2 hybrids, a relatively high variability in fiber yield was observed. In the studied hybrids, the variational changeableness ranged from 5.03% (F_3L-138 x Sultan) to 12.81% (F_3 (F_{32}K-203 x Namangan-1) × Sultan), meaning that the separation process occurred over a wide range.

Table 3: Variational changeableness of F_3 hybrids involving the Sultan cotton variety on fiber yield.

№	Hybrid combinations	n	К = 2,0										M±m	S	V,%
			25,1-27,0	27,1-29,0	29,1-31,0	31,1-33,0	33,1-35,0	35,1-37,0	37,1-39,0	39,1-41,0	41,1-43,0	43,1-45,0			
1.	F_2(F_{32}K203 × Namangan-1) × Sultan	31	3	3	3	7	11		2		1	1	33,5±1,51	4,80	14,30
2.	F_2(F_{16}K58 type arb) × Sultan	30	2	8		5	8		5	1	1		33,3±1,22	4,76	14,29
3.	F_2(F_{31}K69 type arb) × Sultan	39	1		7	9	14	2	2	2	2		33,2±1,09	4,24	12,75
4.	F_2(F_{24}Namangan-1 × Surxon-5) × Sultan	35		2	2	4	6	12	5	2		2	35,1±0,90	4,53	12,88
5.	F_2L-138 × Sultan	38		1	4	2	7	14	5	3	2		35,5±0,97	4,87	13,70
6.	F_2L-470/1 × Sultan	31	4	1	7	10	3		2	2	1	1	31,9±0,68	3,40	10,64
7.	F_2L-95 × Sultan	30	1	6	3		12		5		2	1	33,5±0,86	4,32	12,88
8.	F_2L-158 × Sultan	33	1	4		9		5	8	2	3	1	35,3±0,74	3,72	10,51
9.	F_2L-200 × Sultan	46		2	3	5	8	10	12		4	2	35,2±1,03	4,02	11,42
10.	F_2MVG-2 × Sultan	74	2	2		2	4	15	22	16	4	7	37,4±0,91	4,17	11,13
11.	F_2L-58 × Sultan	50	2	3		10	15		12	5		3	33,6±1,22	5,35	15,90
12.	F_2L-1979 × Sultan	45		1	4	2	11	9	10	6	2		36,9±0,73	3,69	9,98
13.	F_2L-175/248 × Sultan	37	2	2		2		6	12	2	8	5	38,9±1,27	5,11	13,14
14.	F_2L-12/06 × Sultan	63	3	5		12	25			10	4	4	33,7±1,38	6,18	18,29
15.	F_2(F_{23}K-58 type arb) × Sultan	66	1	3	2	3	1	6	30	15	2	3	38,8±1,09	3,45	8,90
16.	F_2BSG-2/06 × Sultan	32			1	2		4	18	4		3	37,2±0,72	3,41	9,15
17.	F_2L-588 Sultan	51		7	4	10	16	10		4	3	1	34,0±0,78	3,90	11,47

4. CONCLUSIONS

According to the results of the research, conducted for three years, the hybrids MVG-2 × Sultan, L-175/248 × Sultan and BSG-2/06 × Sultan in the first year were 38.5 ± 1.19, 38.4 ± 1.61. and 37.5 ± 1.38, while in the second year the results were 37.4 ± 0.91, 38.9 ± 1.27, and 37.2 ± 0.72, respectively, in the third year. Results such as 37.4 ± 0.92, 37.6 ± 0.94, and 38.4 ± 1.19, which did not differ from the previous two years, were obtained, which may serve as a starting point in future studies.

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