NATURALISTA CAMPANO
ISSN: 1827-7160
Volume 28 Issue 1, 2024

Use of Ecologically Remote Hybridization in the Creation of High Yield Cotton Hybrid Material G.Barbadense l.

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Abstract: The article presents the results of the analysis of the formation of the trait "fiber yield" in ecologically remote linear-varietal hybrids F_1-F_2 of fine-staple cotton, created on the basis of lines of their own selection, as well as varieties of Turkmen and Tajik breeding.
Based on the results of the studies carried out on the basis of "fiber output", the following conclusions are drawn:
- the sign "fiber output" against the background of artificially infected X.malvaceanum: - differentiates in its value, both among the original forms and F_1-F_2 hybrids, that is, high-yielding hybrids suitable for further use in breeding have been created;
- the value of the dominance index (hp) indicates the presence of dominance effects in two F_1 hybrids, namely, negative incomplete dominance of the worst parent and positive incomplete dominance of the best parent;
- from the analysis of variational series and by the value of the heritability coefficient (h_2), it was found that the trait "fiber output" is inherited at an average and high level, and a significant number of plants with a high value of the analyzed trait were identified.

Keywords: cotton, G. barbadense. L, line, grade, hybrid, generation, trait, fiber output

1. Introduction

The variety of soil and climatic conditions in Central Asia pose exceptionally difficult problems for cotton growing. The peculiarity lies in the fact that, in terms of the nature of the distribution and intensity of the manifestation of meteorological factors, there is significant instability over the years and during the growing season.
In solving the problem of increasing the productivity of lands in cotton-growing regions, the main place belongs to the variety.
However, today the issue of the varietal structure of G. barbadense L. cotton has not been resolved, taking into account the optimal combination of its yield and fiber quality with early maturity. This is primarily due to the lack of a sufficient number of modern ultra-early, high-yielding varieties with a high quantity and quality of type I-A fiber.
In connection with the above, special attention is paid to the further development of agriculture, including cotton growing, which is reflected in the third priority area of the Action Strategy for 2017-2021. Decree of the President of the Republic of Uzbekistan No. UP-4947 dated February 7, 2017 “On the strategy of actions for the further development of the Republic of Uzbekistan”1 “expanding research work to create new breeding varieties of agricultural crops with high yields, resistant to diseases and pests, adapted to soil-climatic and ecological conditions”.
This study, to a certain extent, serves to fulfill the tasks stipulated by the Law "On Breeding Achievements" of August 29, 2002, the Decree of the President of the Republic of Uzbekistan No. 2021”, “Development of fine-staple cotton growing” Resolution No. 47 dated 01/30/2020, the Cabinet of Ministers of the Republic of Uzbekistan and Presidential Decree No. 5009 dated February 26, 2021, adopted in this area.
Great prospects for obtaining valuable source material and breeding material of cotton of the G. barbadense L. species open up when lines and varieties of domestic and foreign selections are involved in hybridization, which are distinguished, first of all, by high early maturity of 105-110 days, the rate of return of the entire raw cotton crop up to October 10 and a potential fiber yield of 1.5-1.7 q/ha.

Practical application of various methods of hybridization in the breeding of fine-staple cotton varieties , (2021), made it possible to solve the urgent problem of creating varieties resistant to Fusarium oxysporium, combining early maturity and the amount of raw cotton.
In solving this problem, the use of genetic and statistical methods for assessing the results of research is of no small importance. At present, in breeding practice, when evaluating the initial and hybrid material at the first stages of breeding, the method of determining the values of the dominance index (hp) in F_1 hybrids, the heritability coefficient (h_2) of F_2 hybrids, variability (σ) has become widespread, which determines the breeding significance of hybrids , followed by the use of the information obtained in practical selection.

Purpose of the study. Study, evaluation and selection of promising source material and the creation with its participation of a selection-significant distant, linear-varietal hybrid material.

Research objectives. To solve the problem of a specific purpose of research, the following tasks are solved:
-set the degree of dominance (hp), standard deviation (σ) and coefficient of variation (V%) in parental forms and F_1 hybrids;
- to study the nature of the variability and heritability of the trait "fiber output" depending on the genetic origin of the parental components.
The objects of study in laboratory and field experiments were lines of fine-staple cotton of own selection L-1 and L-2, varieties of Turkmen 9709-I, 9906-I, Ashgabat-34 and Tajik Leninabad-19 selections and created hybrids F_1-F_2 with the participation of the above-mentioned initial material.
The subject of research is the established certain genetic patterns of variability, inheritance and heritability of the trait "fiber yield" that contribute to the selection of selection-significant hybrids F_1-F_2 at the early stages of selection.
Thousand-year-old human selection among wild-growing cotton plants growing near dwellings contributed to the emergence of powerful productive plants with a cultural type Abdullaev A.A. (2005, 2006), Abzalov M.F. (2008).
The founders of breeding work with cotton species G. barbadense L. in countries such as Uzbekistan, Tajikistan and Turkmenistan, located in the north of the world cotton belt, are such recognized breeders as Avtonomov A.A. (1973), Avtonomov V.A. (1993), Avtonomov Vik.A. (2006, 2007, 2009), Harland S.C. (1929), Krieg D.R. (1999), Lowell J. (1999).
In 2019-2020, the contractors conducted field studies with the participation of hybrid and breeding material created within the framework of the previously conducted KHA-KH-2018-135 - 2018-2020. and the “Creation of varieties of fine-staple cotton using DNA markers”, which has been held since 2021 and is funded by the Ministry of Innovative Development of the Republic of Uzbekistan.
Field experiments related to the implementation of research were carried out in the laboratory and field conditions of the production department of the Research Institute of Selection, Seed Production and Agricultural Technology of Cotton Growing (NIISSAVH), which is located in the Tashkent region of the Republic of Uzbekistan.

2. Materials And Methods

The temperature conditions of 2021 during the field experiments turned out to be favorable. Sowing in the indicated period was carried out on April 16-17. 50% of seedlings were obtained on April 28-29 after feeding watering. The plants developed at constantly rising temperatures, and the hot summer and warm autumn made it possible to complete the harvesting of the experimental seed raw cotton by September 20. Agrotechnical measures are typical for this area of cotton cultivation.
Each plant of hybrids F_1 - F_2, as well as varieties and lines used in hybridization and varieties-standards and varieties-indicators were labeled. For each hybrid combination, it was studied: in F1 from 30 to 50 plants, in F2 and varieties involved in the experiment from 120 to 150 plants.
Lines, varieties and hybrids F_1 - F_2 were studied in equalizing sowing under conditions of one year, in triplicate, in randomized blocks.
The harvesting of raw cotton was carried out individually from each plant, then the harvested raw cotton was weighed, ginned and re-weighed separately for fiber and seeds, then the value of the trait "fiber output" was determined.
Field experiments, as well as phenological observations and biometric descriptions, were carried out according to the method of breeding work with cotton (VNIISSH, 1968). The reliability of the experience and other statistical indicators were calculated using a special computer program.

Based on the actual data, variation series were compiled according to the trait under study.
The degree of dominance of F_1 populations on the basis of the "mass of raw cotton of one box" was judged by the value of the dominance index (hp), calculated by the formula given in the work of Beil G.M., Atkins. (1965).
The degree of heterogeneity of F_2 populations was judged by the magnitude of genotypic variability - the coefficient of heritability (h2), calculated by the formula given in the work of Allard R.W. (1966).
The field experience involved the initial materials involved in the hybridization of Uzbek L-1 and L-2, varieties 9709-I 9906-I, Ashgabat-34 Turkmen and Leninabad-19 varieties of Tajik selection, as well as F1-F2 hybrids obtained by pair hybridization.

3. Results And Discussion

As a result of the analysis of the results of field studies on the background artificially infected with the X.malvaceanum pathogen on the basis of the “fiber yield”, which are presented in Table 1, it can be seen that the variety of the Tajik selection Leninabad-19 had the maximum average value of the trait “fiber yield” among the original forms, it equals 36.1% and for the standard variety Surkhan-14 at the level of 34.7%. The minimum value of the analyzed trait was found in L-2, which is 31.8%. For the rest of the varieties and lines involved in hybridization and the indicator variety 8763-I, it ranges from
31.9% in L-1 to 34.3% in the Turkmen variety 9906-I.
The trait "fiber yield", as can be seen from Table 1, in F1 hybrids is at the level or exceeds the parental forms and ranges from 33.0% in L-2 x Ashgabat-34 and L-2 x 9709-I to 33.9% in L -1 x Ashgabat-34 and L-2 x Ashgabat-34.
Judging by the values of the dominance index (hp), in three F1 hybrids, a negative effect of incomplete dominance of a low-output parent was established, while the value of which ranges from -0.07 in L-2 x Ashgabat-34 to -0.2 in L-1 x Leninabad-19 , and the rest showed a positive effect of incomplete dominance of the best parent, which ranges from 0.08 in the L-2 x 9709-I hybrid to 0.8 in L-2 x 9709-I, which is important from a breeding point of view.
As can be seen from the analysis of the results of field studies, the average value of the trait “fiber yield” in two F_2 hybrid combinations exceeds the parental forms and is at the level of 35.1% for L-1 x Leninabad-19 and 34.9% for L-2 x Leninabad-19.

TABLE 1. Variability and heritability of the trait "fiber output" in ecologically distant, linear-varietal hybrids F_1-F_2 against the background of artificially infected X.malvaceanum

Variety, hybrid combination	n	K = 2%									M±m %	∂	V%	hp	h^2
		25-26.9	27-28.9	29-30.9	31-32.9	33-34.9	35-36.9	37-38.9	39-40.9	41-42.9					
Surkhan -14 (st)	15					5	7	3			34.7±0.36	1.4	2.0		
8763-И (ind)	8		2	5	1						29.3±0.4	1.2	1.44		
L-1 - F6 L-915 x	35			7	20	8					31.9±0.2	1.3	1.7		
L-2 [F_{10}[F_{15}(C-6013 x 5904-И] x Л-396 б]]	105			20	66	19					31.8±0.1	1.2	1.5		
9709-И	11				2	6	3				34.1±0.4	1.3	1.7		
9906-И	17				2	12	3				34.3±0.2	1.0	1.16		
Ash-34	17				4	4	9				34.5±0.4	1.6	2.7		
Leninabad -19	45					9	22	14			36.1±0.2	1.4	2.0		
L-1 x 9906-И	10				1	7	2				33.8±0.4	1.4	2.0	0.5	
L-2 x 9906-И	79	3	5	11	8	30	14	8			33.3±0.3	3.0	9.0		
F_1 L-1 x Ash-34	9				1	6	2				33.9±0.9	1.8	7.8	0.5	
F_2L-1 x Ash -34	21	1	1	3	3	7	1	2	3		33.7±0.8	3.8	14.4		0.8
F_1L-1 x Leninabad -19	14				3	10	1				33.6±0.3	1.2	1.4	-0.2	
F_2L-1 x Leninabad -19	102		2	5		24	30		7		35.1±0.2	2.7	7.4		0.8
F_1L-1 x 9709-И	4				1	1	2				33.9±1.5	1.1	9.6	0.8	
F_2L-1 x 9709-И	17	1	1	1	3	4	5	2			33.5±0.7	3.2	10.4		
F_1L-2 x 9906-И	11				2	8	1				33.8±0.5	1.9	3.6	0.6	

F_2L-2 x 9906-И	43	1	2	2	5	12	8	8	1		34.0±0.4	3.0	9.0		
F_1 L-2 x Ash -34	6				1	3	2				33.0±1.0	1.6	6.7	-	
F_2L-2 x Ash -34	32			5		6	8	1	1	1	32.7±0.3	2.0	4.0		
F_1L-2 x Leninabad -19	13				3	8	2				33.6±0.3	1.3	1.7	-	
F_2 L-2 x Leninabad -19	82		1			16	22		7	1	34.9±0.3	3.0	9.0		
F_1L-2 x 9709-И	4				1	3					33.0±0.4	0.8	0.6		
F_2L-2 x 9709-И	33		1	5	6	12	5	2	2		33.7±0.4	2.8	7.9		0.8

Analyzing the value of the standard deviation (∂), which is presented in Table 1, it can be seen that in such initial forms and the standard variety Surkhan-14, and a number of F_1 hybrids, it ranges from 0.8 in the L-2 x 9709-I hybrid to 1.8 in hybrid L-1 x Ashgabat-34.
In F_2 hybrids, it is 1.5-2 times higher than in F_1 hybrids and ranges from 1.2 in the hybrid L-2 x Ashgabat-34 to 3.8 in the hybrid F_2 L-1 x Ashgabat-34, which indicates the possibility of isolating individual plants with the value of the analyzed trait higher than that of the original forms involved in hybridization.
The value of the coefficient of heritability (h^2) indicates the heritability of the analyzed trait at an average and high level, while its value ranges from 0.6 in one hybrid, in two at the level of 0.7 and in four its value is 0.8, as can be seen from the results of the studies presented in table 1.

4. Conclusion

Based on the analysis of the results of field studies on the basis of "fiber output", which are presented in Table 1, the following conclusions should be drawn:
- the sign "fiber output" against the background of artificially infected X.malvaceanum: - differentiates in its value, both among the original forms and F_1-F_2 hybrids, that is, high-yielding hybrids suitable for further use in breeding have been created;
- the value of the dominance index (hp) indicates the presence of dominance effects in two F_1 hybrids, namely, negative incomplete dominance of the worst parent and positive incomplete dominance of the best parent;
- from the analysis of variational series and by the value of the heritability coefficient (h^2), it was found that the trait "fiber output" is inherited at an average and high level, and a significant number of plants with a high value of the analyzed trait were identified.

5. References

1. Abdullaev A.A., Klyat V.L., Rizaeva S.M. Evolutionary-historical aspects of natural and artificial selection to increase the precocity of cotton. //Materials of the international scientific-practical conference - Tashkent: Fan, 2005. - P.9-10.
2. Abdullaev A.A., Klyat V.L., Rizaeva S.M., Ernazarova Z.A. Kuryazov Z.B., Arslanov D.M. Possibilities of using wild relatives of cotton to improve and create cultivated varieties. "The state of selection and seed production of cotton and the prospects for its development", //Materials of the international scientific and practical conference - Tashkent. 2006. - P.5-8.
3. Abzalov M.F. Interaction of genes in cotton G.hirsutum L. Monograph under the direction of academician Musaev D.A. - Tashkent: Fan, 2008. - 124 p.
4. Avtonomov A.A. Breeding of fine fiber varieties of cotton. -Tashkent: Fan, UzSSR. 1973.- P.144.
5. Avtonomov V.A. Genetic aspects of selection of disease-resistant varieties of cotton with increased yield and fiber quality. Abstract diss… doc. agricultural Sciences - Tashkent, 1993. - 64 p.
6. Avtonomov Vik.A. Geographically distant hybridization in the selection of medium fiber varieties of cotton. - Tashkent: Mehridaro, 2006. - 102 p.
7. Avtonomov Vik.A. Plant productivity with distant hybridization. //AND. Cotton growing. "Ear". 1984. No. 3. - S.27-28.
8. Avtonomov Vik.A. Source material for cotton breeding. //Materials of the international scientific-practical conference - Tashkent: Fan, 2005. - P.19-21.
9. Avtonomov Vik.A. Geographically distant hybridization in the selection of medium fiber varieties of cotton. - Tashkent: Mehridaro, 2006. - 102 p.

10. Avtonomov Vik.A. Variability, inheritance of traits in geographically distant F1-F2 hybrids of cotton G.hirsutum L. “The state of selection and seed production of cotton and development prospects” / / Proceedings of the international scientific-practical conference - Tashkent. 2006.- S.36-41.
11. Avtonomov Vik.A. Intervarietal hybridization in the creation of new varieties of cotton species G.hirsutum L. -Tashkent: Mehridare, 2007. - 120 p.12. Avtonomov Vik.A., Egamberdiev R.R., Kimsanbaev M.Kh. Geographically distant hybridization in the selection of cotton G.barbadense L. - Tashkent, "Mehridare". 2009. - 174 p.
12. Ravshanov A.E., Avtonomov V.A. Selection of modern varieties of cultivated cotton species in Uzbekistan Monograph. 2021 International Book Market Strvice Ltd, member of OmniSciptum Publishing Group 17 Meldrum Street, Beau Bassin 71504. 155 p.
13. Allard R.W. Principles of Plants Breeding, John Willey, Sons. New-York-London-Sidney, 1966.
14. Beil G.M., Atkins. Inheritance of guantitave characters in grain sorgum // Jowa State Journal of Science. 1965.
15. Harland S.C. Early maturity in cotton. “Trop. Agr.”, v.6, 1929, p. 114-1/
16. Ken E. Lege. New early maturing Iransgenelic varieties horn ‘ire grow: SG125B/R, SG125R, SG501B/R, SG585B and SG585R.
17. Krieg D.R. Water Use and Walei list1 1.1liciency of Cotton in West Texas, Bellwide Cotton Conferences,1999,p. 569
18. Lowell J. Zeiinski and Marc Bales. Relationship Between Lint elds and Selected Plant Mapping Data, Beltwide Cotton Jmferencees, 1999, p.530