Formation and Variability of the "Weight of Raw Cotton 1 Box" In F1 Hybrids Created on the Basis of Hybridization of American Selection Varieties

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Abstract. In the article in the introduction section, the problem being solved, the purpose and objectives of the research are given in detail. Then, in accordance with the requirement, the place and conditions for the experiment are given. The following are the results of hybridological and variational-statistical analyzes of studies aimed at studying the variability and inheritance of the trait "mass of raw cotton in one box" in intervarietal F1 hybrids. The above hybrids were created as a result of crossing the best varieties of American breeding, isolated from 132 previously unstudied collection varieties. As a result, a large-boxed hybrid combination F1: Hopi oraibi BI x Lambright GL-5 with a raw cotton weight of one box of 6.4 g was isolated and two hybrid combinations in which the effect of heterosis was established, which should be used in further breeding work aimed at breeding large-bodied varieties of cotton of the species G. hirsutum L.

Key words: cotton, inheritance, variability, first generation, cotton mass.

1 Introduction

In the third priority direction of the Decree of the President of the Republic of Uzbekistan "On the strategy of action for the further development of the Republic of Uzbekistan in 2017 - 2021" [1], special attention is paid to agriculture, including cotton growing, which is tasked with solving the problem of "expanding scientific research work to create and the introduction of new breeding varieties of agricultural crops with high productivity, resistance to diseases and pests, adapted to local soil-climatic and environmental conditions" (UP - 4947, 2017) [2].

The study was carried out in order to study the genetic potential of previously unexplored American collection varieties of cotton of the species *G.hirsutum* L., select and involve the best in the breeding process aimed at creating promising breeding material with a large box.

Research objectives:

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- to study the variability and inheritance of the trait "mass of raw cotton 1 box" in hybrids F_1;
- highlight promising, early maturing F_1 hybrid combinations with a large box.

2 Literature review

The most important component of the yield is the mass of raw cotton in one box, which has been studied in the last century. There is a direct correlation between the mass of raw cotton of one box with the mass of seeds and, as a rule, an inverse relationship with fiber. The works of many scientists confirm [3] that the heritability of the size of the box is higher than the heritability of individual elements of productivity.

A. Sadikov, having studied 15 hybrids in 2014-2015, installed with a large box: Cocer-4104 x Dusti-IZ, Nazilli-84 (92-13) x Dusti-IZ, Nazilli-84-S x Dehkon, which amounted to 7.4 d. The mass of raw cotton in one boll in the created and isolated hybrids is 1.9 g more than the mass of raw cotton of the standard variety Hisor [4].

Sh. Karomatov and others, having studied 7 parental varieties of the species G. Hirsutum L. with a raw cotton weight of 4.9 to 6.1 g, and hybrids of the first generation obtained as a result of their crossing with a raw cotton weight of 1 box from 5, 4 to 7.2 g were recommended for further breeding work aimed at obtaining highly productive varieties with a large box, the Khulbuk variety with an indicator of this trait of 6.1 g and hybrid combinations F_1 Guliston-2 x Khulbuk, F_1 Kyrgyz-3 x Khulbuk and F_1 Ziratkor -64 x Hisor with an indicator of this trait, respectively, 7.0; 7.1 and 7.2 years [5].

I. E. El-Beially and G. I. Mohamed, S. H. Abd-El-Haleem, et al., [6; 7; 8], having studied the quantitative traits of first generation hybrids, came to the conclusion that quantitative traits in the first generation are inherited at almost all levels.

A. I. Zeynalova [9], having crossed the Ayzerbaidzhan variety with geographically distant varieties of cotton, singled out for further breeding work the ancestral variety Ganja-110 and the hybrid combination F1 Ganja-110 × Select, which surpassed or were at the level of the best parent in the following traits: cotton weight -raw 1 box, length and fiber yield.

V. A. Avtonomov et al. [10], as a result of studies carried out within the framework of the mega project VA-F-5-020, obtained the following results on the trait we studied - “mass of raw cotton 1 box”: standard variety Namangan-77 - 6.1 g, and samples of the HAC population involved in the experiment L-1000, where M = 7.1 g, Catamarca-811, where M = 6.7 g, L – 3 – M = 7.1 g, and L – 6 – M = 7.0 g. that are of interest from a breeding point of view.

In the studies B. A. Sirozhidinov [11], the trait “mass of raw cotton of one box” in F1C hybrids obtained on the basis of intraspecific crossing, by the method of experimental polyploidy, ranges from 4.7 to 5.4 g. In the hybrid combination F_1C G. hirsutum ssp. euhirsutum (Namangan 77) x (G.arboreum ssp. obtusifolium var. indicum x G.australe) the studied trait is 4.7 g (range of variability is 3.9-5.8 g). The dominance coefficient hp = 0.5 is intermediate. The F_1C hybrid combination G.hirsutum ssp. euhirsutum (Kelajak) x (G.arboreum ssp. nanking (with white fiber) x G.nelsonii) the studied trait is 5.4 g (variability range 4.8-6.0 g). The dominance coefficient hp = 0.5 is intermediate [12-15].

3 Materials and methods

The studies were carried out at the NIISSAVKh in the field conditions of the central experimental site. The institute is located 3 km. from the northeast side, 41º 20 north latitude, 69º 18 east longitude, Tashkent region, Kibray district, Salar town. The soil of the

experimental farm is a common serozem, the level of underground groundwater is 7-8 m and is located at an altitude of 584 m above sea level.

The materials for the research were indicator varieties C-6524 and Bukhara-102, 10 hybrid combinations F_1 and 10 parents - varieties of American selection used in hybridization.

The studies used comparative morphology, phenological observations and modern methods of genetic and statistical analysis.

4 Results and Discussions

Based on the analysis of the results of field studies, as can be seen from Table 1, the average value of the trait "mass of raw cotton 1 box" in varieties of American selection ranges from 5.0 in the variety sample of the American selection Werden to 6.6 g in the variety sample of the American selection Hopi oraibi BI, and in hybrid combinations from 5.0 in the intervarietal hybrid F_1 Dand PL 10-1 x Stoneville-132 to 6.4 g in the hybrid F1 Hopi oraibi BI x Lambright GL-5, this is evidenced by the data in Table 3.8 obtained from analysis of the results of studies conducted in 2021.

Analyzing the value of the standard deviation (δ), which is presented in Table 3.8, it should be said that it characterizes the stability of both the initial material and the F_1 hybrids and ranges from 4.4 for the intervarietal hybrid combination F_1 Acala 1517c x Werden to 9.4 for variety sample of the American selection Dand PL 10-1.

Table 1. Variability and inheritance of the trait “mass of raw cotton 1 box” in intervarietal F1 hybrids created as a result of crossing varieties of American selection

№	Сорт-indicator, grade, hybrid combination	n	K=1 gr			M±m gr	δ	V%	hp
			4	5	6				
1	C-6524-ind.	43	5	35	3	4.8±1.0	6.5	134.7	
2	Bukhara -102-ind.	42	3	36	3	5.5±0.9	5.7	103.1	
3	Stoneville-132	37	3	30	4	5.9±1.1	6.5	110.5	
4	Dand PL 10-1	28	4	19	5	5.0±1.8	9.4	189.4	
5	Lambright GL-5	35	3	30	2	5.1±1.0	5.7	111.8	
6	Hopi oraibi BI	28	1	24	3	6.6±1.1	5.7	86.2	
7	Acala 1517c	7	1	5	1	6.5±3.0	8.0	123.4	
8	Werden	30	3	25	2	5.0±1.1	6.1	122.5	
9	Station	53	6	42	5	5.2±0.9	6.8	131.0	
10	King 101-3-10 # spot	68	8	49	11	6.2±1.0	7.9	128.7	
11	Durango cluster	30	5	20	5	5.5±1.6	8.7	157.5	
12	Acala 911 Exposed	66	5	55	6	5.7±0.8	6.1	106.9	
13	F_1 Stoneville-132 x Dand PL 10-1	14	2	10	2	5.8±2.1	8.0	138.2	0.8
14	F_1 Dand PL 10-1 x Stoneville-132	29	5	20	4	5.0±1.6	8.4	167.7	-1.0
15	F_1 Lambright GL-5 x Hopi oraibi BI	51	2	45	4	6.1±0.7	5.1	84.5	0.3

16	F_1 Hopi oraibi BI x Lambright GL-5	50	2	43	5	6.4±0.8	6.0	93.7	0.7
17	F_1 Acala 1517c x Werden	46	2	41	3	5.8±0.7	4.4	75.9	0.1
18	F_1 Werden x Acala 1517c	57	3	50	4	5.8±0.7	5.3	91.2	0.1
19	F_1 Station x King 101-3-10 # spot	45	2	41	2	5.5±0.7	4.5	81.3	0.6
20	F_1 King 101-3-10 # spot x Station	63	5	51	7	6.0±0.8	6.5	109.5	0.6
21	F_1 Durango cluster x Acala 911 Exp.	54	4	45	5	5.8±0.8	6.1	106.0	2.0
22	F_1 Acala 911 Exp. x Durango cluster	57	5	46	6	5.8±0.9	6.6	114.3	2.0

Analyzing the value of the "coefficient of variation" which is presented in table 1, it should be said that it characterizes the stability of both the source material and the F_1 hybrids and ranges from 75.9% for the F_1 hybrid combination Acala 1517c x Werden to 167.7% for the intervarietal combination hybrid combination F_1 Dand PL 10-1 x Stoneville-132, which must be taken into account in further breeding work aimed at obtaining breeding material with a large box.

The established values of the index of dominance (hp) which are presented in table 1 indicate heterosis in hybrid combinations F_1 Acala 911 Exp. x Durango cluster, F_1 Durango cluster x Acala 911 Exp. with 2.0 hp. Partial dominance was found in hybrid combinations F_1 Stoneville-132 x Dand PL 10-1, in which the dominance index is 0.8; F_1 Hopi oraibi BI x Lambright GL-5 with a dominance score of 0.7; F_1 Station x King 101-3-10 # spot and F_1 King 101-3-10 # spot x Station, whose dominance index is 0.6; F_1 Lambright GL-5 x Hopi oraibi BI with a dominance score of 0.3; F_1 Acala 1517c x Werden and F_1 Werden x Acala 1517c whose dominance index is 0.1. The negative effect of complete dominance was found in the hybrid combination F_1 Dand PL 10-1 x Stoneville-132, whose dominance index is -1.0.

5 Conclusion

Based on the analyzes of the studies carried out on the basis of "mass of raw cotton 1 box", it is necessary to highlight:

- the original form of Hopi oraibi BI with a box weight of 6.6 g;
- intervarietal hybrid combination F_1 Hopi oraibi BI x Lambright GL-5, the average indicator of the analyzed trait of which is 6.4 g. for the removal of large-box forms.

References

1. Decree of the President of the Republic of Uzbekistan UP - 4947 "On the strategy of action for the further development of the Republic of Uzbekistan" dated February 7, (2017).
2. B.U. Tadjiev, J.E. Ataev, E.M. Akhmetshin, V.L. Vasilev, V.S. Kukhar. Assessment of the effectiveness of the reforms to support entrepreneurship in Uzbekistan. E3S Web of Conferences, **396,** (2023).
3. A.M. El-Zanaty, K.F.M. Salem, R.M. Esmail. Detection of Genetic Diversity in Egyptian cotton (G.barbadense L.) varieties using RAPD markers and morphological traits. Nature and Science, **10(1),** 123 (2012).

4. A. T. Sadikov. The study of economically valuable traits of introgressive genotypes of medium fiber cotton. Agricultural technologies, **1(3),** 17-20(2019).
5. Sh. Karomatov, S. Dzhabarov, S. Rasulov. General combining ability of hybrids of medium staple cotton (g. Hirsutum L.) Reports of the Tajik Academy of Agricultural Sciences. **4 (42),** 7-10 (2014).
6. I.E. El-Beially, G.I. Mohamed. Estimates of genetic parameters using six populations in Egyptian cotton (G barbadense L.). Al-Azhar J. Agric. Res.,.**4**, 305-329 (2008).
7. S.H. Abd-El-Haleem, M.R. Ehab, Metwali & M.M. Ali. Al Felaly. Genetic Analysis of Yield and its Components of Some Egyptian Cotton (G. barbadense L.) World Journal of Agricultural Sciences, **6(5),** 615-621(2010).
8. V.A. Yemelyanov, A.A. Nedelkin, L.A. Olenev. An Object-Oriented Design of Expert System Software for Evaluating the Maintenance of Lined Equipment. International Multi-Conference on Industrial Engineering and Modern Technologies, FarEastCon 2019, art. no. 8934414
9. A.. Zeinalova. Study of Heterosis in Hybridization of Geographically Distant Gossypium Varieties. Bulletin of Science and Practice, **8(2),** 91-97 (2022).
10. V.A. Avtonomov, A.Yo. Kurbonov, Sh. Khodzhanov, S. Dzhumaev, U.K. Kayumov. Forms and HAC-populations of different generations of cotton species G. Hirsutum L. Actual problems of modern science, **(2),** 127-130 (2020).
11. B.N. Nasiyev, A.K. Bekkaliyeva, T.K. Vassilina, V.A. Shibaikin, A.M. Zhylkybay. Biologized Technologies for Cultivation of Field Crops in the Organic Farming System of West Kazakhstan, Journal of Ecological Engineering, **23 (8),** 77-88 (2022). doi: 10.12911/22998993/150625
12. G. Singh, N. Kalra, N. Yadav, A. Sharma, M. Saini. Smart agriculture: a review. Siberian Journal of Life Sciences and Agriculture, **14(6),** 423-454(2022). doi: 10.12731/2658-6649-2022-14-6-423-454
13. O. Y. Voronkova, E. M. Akhmetshin, I. N. Sycheva, R. N. Shpakova, E. Y. Pashkova, A. L. Poltarykhin. Economic mechanism of regulating land relations in the agricultural sector of russia. European Research Studies Journal, **21(4),** 280-291(2018). doi:10.35808/ersj/1120
14. E. M. Akhmetshin, A. V. Plotnikov. Sentiment analysis of client reviews of the russian agricultural bank service and predicted rating reviews. Paper presented at the IOP Conference Series: Earth and Environmental Science, 548(2) (2020). doi:10.1088/1755-1315/548/2/022042
15. P. Kuzmin, T. Skoblikova, S. Gorovoy, O. Otto. Research of the state of woody and brushwood plants under anthropogenic stress conditions. Siberian Journal of Life Sciences and Agriculture, **15(1),** 141-163 (2023). doi: 10.12731/2658-6649-2023-15-1-141-163