Т. 8. №2. 2022
https://doi.org/10.33619/2414-2948/75

UDC 621.523.575.631.51
AGRIS F30
https://doi.org/10.33619/2414-2948/75/12

STUDY OF HETEROSIS IN HYBRIDIZATION OF GEOGRAPHICALLY DISTANT *GOSSYPIUM* VARIETIES

©Zeinalova A., *Azerbaijan State Agrarian University,*
Ganja, Azerbaijan, zeynalova92.9292@mail.ru

ИЗУЧЕНИЕ ГЕТЕРОЗИСА ПРИ ГИБРИДИЗАЦИИ ГЕОГРАФИЧЕСКИ УДАЛЕННЫХ СОРТОВ ХЛОПЧАТНИКА

©Зейналова А. И., *Азербайджанский государственный аграрный университет,*
г. Гянджа, Азербайджан, zeynalova92.9292@mail.ru

Abstract. In the study, hybridization was carried out between the local *Gossypium* variety and geographically distant *Gossypium* varieties to obtain a selection starting material. To determine the effect of heterosis, hybrids obtained from the crossing of Ganja-110 *Gossypium* variety with geographically distant cotton varieties were studied, F_1 generation hybrids showed a positive dominance in terms of growing season. The fiber yield of F_1 hybrids of Ganja-110 × Selekt hybrid combination was the dominant hereditary character. In F_1, the mass of raw cotton obtained from one cocoon was close to the parent form with a larger cocoon in hybrids obtained for all combinations. F_1 hybrids were superior in fiber length compared to their parent forms. In the F_1 hybrid offspring, all combinations were close to the parent form with high fiber length. The individual samples collected according to the characteristic shown in F_3 were higher than the parent form, and sometimes closer to the parent form with higher fiber length. The individual samples collected from the hybrid seeds studied in the experiment were quite effective.

Аннотация. В ходе исследования была проведена гибридизация местного сорта и географически удаленных сортов хлопчатника для получения исходного материала для селекции. Для определения эффекта гетерозиса были изучены гибриды, полученные от скрещивания сорта хлопчатник Гянджа-110 с географически удаленными сортами хлопчатника, гибриды поколения F_1 показали положительное преобладание по срокам вегетации. Урожайность волокна гибридов F_1 гибридной комбинации Гянджа-110 × Селект была доминирующим наследственным признаком. В F_1 масса хлопка-сырца, полученного из одного кокона, была близка к массе родительской формы с более крупным коконом у гибридов, полученных для всех комбинаций. Гибриды F_1 превосходили по длине волокон их родительские формы. У потомства гибрида F_1 все комбинации были близки к родительской форме с большой длиной волокна. Отдельные образцы, собранные в соответствии с характеристикой, показанной в F_3, были выше, чем исходная форма, а иногда и ближе к исходной форме с большей длиной волокон. Отдельные образцы, собранные из изученного в эксперименте гибридного потомства, оказались весьма эффективными.

Keywords: Gossypium, variety, hybrids, geographical distance, capsule, fiber yield.

Ключевые слова: хлопчатник, сорт, гибриды, географическая удаленность, коробочка, урожайность волокна.

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Modern selection uses a wide range of scientific methods to increase the productivity of agricultural crops, their resistance to diseases and pests. A more widely used and still used method is the hybridization method, in which a feature is transmitted to the created variety.

Numerous studies on the genetics and selection of cotton have shown that many cotton varieties in different geographical conditions have been introduced, studied extensively, and used as a desirable donor in selection and genetic research. Thus, geographically remote cotton varieties are resistant to drought, unfavorable climatic conditions, diseases and pests, as well as have other economic value. Therefore, the aim of all theoretical and practical research on the cotton crop is to study ways to use the rich potential of geographically distant cotton varieties. In this regard, the work of creative selection involves the determination of the laws of heredity and variability in the acquisition of new varieties and the use of accumulated experience. The feasibility of using heterozygous hybrids of agricultural crops has long been in the spotlight. Productivity can be significantly increased by the widespread use of heterozygous hybrids in production. It is possible to significantly increase productivity and improve product quality by using high-heterosis hybrids of cotton in production.

The first generation of heterosis-hybrids (F1) is a phenomenon of increased viability, accelerated growth and development in relation to their parental forms, increased productivity in all extreme conditions, resistance to disease and pests. Hybrids with the power of heterosis grow faster, develop more, and form more fruit organs, which in turn leads to higher yields. The formation of hybrid power in the first generation of hybrids depends on the degree of diversity of the parents, and this power can be used in practice. The force of heterosis results from the compression of the dominant allele by a recessive allele. At present, the physiological and biochemical properties of hybrids with heterosis and their parent forms are being actively studied. The essence of the physiological and biochemical properties of high-yielding hybrids is the result of increased intensity of genetic interactions in hybrid organisms, which leads to the effect of heterosis.

Ch. Y. Reznik [1, p. 18-20], I. Z. Zeinalov [2, p. 50–51] note that in order to obtain hybrids with heterozygous force as a result of crossbreeding of different varieties, first of all, the parent forms must be chosen correctly.

L. C. Sadikhova [3, p. 25–30] shows that to obtain hybrids with high heterosis strength, varieties with high combinability, such as parental forms, should be taken. In hybrids obtained from the crossing of such varieties, all the features of economic value show higher results. The results of long-term studies show that the force of heterosis is stronger in hybrids obtained during the hybridization of geographically distant cotton varieties. As a result of hybridization, the force of heterosis observed in the first generation of hybrids becomes stronger. In this case, geographically distant cotton varieties were taken as parental forms.

In hybrids obtained because of geographical remote hybridization, strong growth and high fruit organs accumulation are observed in the first generation. Heterogeneous forces are also observed in geographically distant hybrids due to productivity, early maturity, bolls' size, fiber index, fiber length and fineness. Hybrids outperform their parents in terms of productivity and the most productive parent indicators. The productivity of hybrids in individual combinations can exceed the best parental productivity by 30-40% and more.

I. Z. Zeinalov [4, p. 10-13] notes that it is possible to obtain hybrids with high heterosis force even in geographically remote hybridization. However, this depends on the correct choice of parental forms. Thus, the sooner the parent forms have large, coarse, productive, high-quality fiber, the higher these values will be in the obtained hybrids. However, it should be noted that the force of

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heterosis is unique to the first generation of hybrids. Thus, because of strong division in the second generation, the force of heterosis is sharply weakened.

Due to the strong heterozygous force observed in cotton plants, the issue of practical use of this effect has always been in the center of attention. However, this is still unresolved. This is because hybrid seed material, which has the power of heterosis, can only be obtained by crossbreeding.

Materials and methodology

The research was conducted in the experimental field of the Ganja Regional Agrarian Science and Innovation Center (Ganja RAEIM) in Samukh region (2017-2020). As a research material, the local cotton variety Ganja-110, which was obtained without self-pollination of seeds for 2 years in the technical plant selection department of The Institute of Crop Protection and Technical Plants, was introduced from cotton-growing countries — BA-440 (Turkey), Selekt (Greece), Acala beret (Israel), S-6524 (Uzbekistan), Tashauz-68 (Turkmenistan) cotton varieties were used.

Each variety was carried out in 4 rows, 4 repetitions and by hand in the second decade of April on a 60x20 cm x 1 plant scheme with a length of 15 m in each row. After the first performance in the field, phenological observation is carried out every day and 50% of the seedling acquisition report is recorded on the relevant working form. The first dilution was carried out by keeping 2-3 plants in each nest, and the second dilution was carried out by keeping 1 plant in each nest when the second true leaves were formed. During the growing season, field inspections were carried out 3-4 times at different stages of plant development. In order to create a starting material for selection practice, crossbreeding was carried out between the local Ganja-110 cotton variety and geographically distant cotton varieties. 50 flowers were cast and pollinated according to the methodology for each combination.

The number of fertilized and hybrid bolls and seeds obtained from crossbreeding was determined. Hybrid seeds were sown in F_1, raw cotton from all bushes was harvested and planted as a separate family in F_2. Individual samples collected in F_3 will be involved in the selection field after analysis. Heterogeneity will be studied in hybrids obtained from hybridization between local cotton varieties and imported cotton varieties.

In our study, hybridization was carried out between the local Ganja-110 cotton variety and geographically distant cotton varieties to obtain a selection starting material. To determine the effect of heterosis, hybrids obtained from the crossing of Ganja-110 cotton variety with geographically distant cotton varieties were studied.

The heredity of the sign of early maturity of hybrids obtained by crossing Ganja-110 cotton variety with geographically distant cotton varieties has been determined. In the F_1 hybrid generation, the vegetation period in the Ganja-110 x BA-440 hybrid combination was faster than that of the parent pairs. A similar situation was observed in the F_2 and F_3 generations. The vegetation period of the individual samples collected as a result of the directional selection was shorter than that of the parent forms. In other hybrid combinations, the vegetation period was close to the parent form, and the father was shorter than the parent form. Also, in the F_2 and F_3 generations, the growing season was intermediate. Thus, F_1 generation hybrids showed a positive dominance in terms of vegetation duration (Table 1).

In the genetics and selection literature, information on fiber yield, one of the most valuable economic traits, is scarce. According to this sign, A. A. Tagiyev [5, p. 48-49; 6, p. 7-11], S. I. Asadov [7, p. 113-115], S. S. Saidov [8, p. 49-50] and others have conducted research. Studies have

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shown that low fiber yield dominates over high fiber yield in F_1. A similar opinion was expressed by D. A. Musayev [9, p. 43–45].

Table 1

CHARACTERISTICS OF VEGETATION PERIOD OF HYBRIDS OBTAINED FROM CROSSING OF "GANJA-110" COTTON VARIETY WITH GEOGRAPHICALLY DISTANT COTTON VARIETIES

Number	*Hybrid combinations*	*Characteristics of parent couples*		*Characteristics of hybrids, day*			
		♀	♂	F_1		F_2	F_3
				M	h_p		
1	Ganja-110 × BA-440	122	142	118	−1.4	121	120
2	Ganja-110 × Select	122	138	125	−0.62	128	124
3	Ganja-110 × Acala Beret	122	140	128	0.42	130	128
4	Ganja-110 × S-6524	122	136	125	−0.57	128	126
5	Ganja-110 × Tashauz-68	122	137	128	0.2	125	127

In F_1 hybrids, fiber yield is intermediate between the initial forms, and in older hybrid varieties, this feature is different in different hybrid combinations. Based on data that are not widely available in the literature, it can be concluded that high fiber yield dominates in hybrids of new light cotton varieties. Hybrids obtained from crossbreeding between Ganja-110 cotton variety and five geographically distant cotton varieties were studied. Fiber yield of F_1 hybrids in Ganja-110 × BA-440 and Ganja-110 × S-6524 hybrid combinations is of intermediate heredity according to parental forms, fiber yield of F_1 hybrids of Ganja-110 × Selekt hybrid combination is dominant, the fiber yield of F_1 hybrids from the Ganja-110 × Acala Beret hybrid combination was dominant. The fiber yield of F_1 hybrids of Ganja-110 x Tashauz-68 hybrid combination was negatively dominant according to the parent forms (Table 2).

Table 2

CHARACTERISTICS OF FIBER YIELD OF HYBRIDS OBTAINED FROM CROSSING OF "GANJA-110" COTTON VARIETY WITH GEOGRAPHICALLY DISTANT COTTON VARIETIES

Number	*Hybrid combinations*	*Characteristics of parent couples*		*Characteristics of hybrids, day*			
		♀	♂	F_1		F_2	F_3
				M	h_p		
1	Ganja-110 x BA-440	38.5	40.0	39.5	0.33	41.0	40.0
2	Ganja-110 x Select	38.5	39.5	40.0	+2	39.5	40.0
3	Ganja-110 x Acala Beret	38.5	36.0	38.0	0.2	39.0	38.5
4	Ganja-110 x S-6524	38.5	36.0	37.0	0.2	37.5	37.0
5	Ganja-110 x Tashauz-68	38.5	37.0	37.5	0.33	38.0	37.0

It was studied in the research the heterosis efficiency of the mass of raw cotton obtained from one boll in the F1 hybrid generation obtained without crossing between Ganja-110 cotton variety and five geographically distant cotton varieties. In F1, the mass of raw cotton obtained from one boll was close to the parent form with a larger boll in hybrids obtained for all combinations.

In the F1 hybrid offspring, most hybrids obtained from most hybrid combinations were close to the parent form of raw cotton obtained from a single boll, but these hybrids had a high level of

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genetic activity for this feature. In the second hybrid generation (F2), the selection of raw cotton from one boll to increase the weight resulted in a significant increase in this feature in subsequent hybrid generations. Thus, an increase in the mass of raw cotton was observed during the selection of F3 hybrid offspring (Table 3).

Table 3

CHARACTERISTICS OF THE MASS OF RAW COTTON FROM ONE COCOON OF HYBRIDS OBTAINED FROM THE CROSSING OF GANJA-110 COTTON VARIETY WITH GEOGRAPHICALLY DISTANT COTTON VARIETIES

Number	*Hybrid combinations*	*Characteristics of parent couples*		*Characteristics of hybrids, day*			
		♀	♂	F_1		F_2	F_3
				M	h_p		
1	Ganja-110 × BA-440	6.3	5.4	6.3	1	6.1	6.0
2	Ganja-110 × Select	6.3	5.1	5.8	1	6.0	6.1
3	Ganja-110 × Acala Beret	6.3	5.5	6.0	0.25	5.8	6.0
4	Ganja-110 × S-6524	6.3	6.1	6.1	0.1	6.0	6.2
5	Ganja-110 × Tashauz-68	6.3	6.0	6.2	0.5	6.0	6.0

Inheritance of an economically valuable feature such as fiber length was studied in hybrids obtained from crossbreeding of Ganja-110 cotton variety with geographically distant cotton varieties (BA-440, Selekt, Acala Beret, S-6524 and Tashauz-68). T. G. Mahmudov [10, p. 21-24], S. S. Ibrahimov [11, p. 152-154] believe that the length of the fiber has different heredity in different combinations of F_1 hybrid offspring. The dominance of the long fiber over the short fiber was observed in only one hybrid combination. In most hybrid combinations in F_2, the fiber length was in the intermediate position relative to the parent forms. In the research conducted by Sadikhova [12, p. 74-75], it was observed that F_1 hybrids were superior to the parent forms in terms of fiber length compared to the parent forms. Hybrid dominance obtained from hybridization of Tashauz-68 variety with Ganja-110 variety in terms of fiber length, F_1 hybrids obtained from crossbreeding of selectively, S-6524 geographically distant cotton varieties with Ganja-110 variety had intermediate heredity in relation to parental forms. In the F_2 hybrid offspring, all combinations were close to the parent form with high fiber length. The individual samples collected in F_3 were higher than the parent form, and sometimes closer to the parent form, which had a higher fiber length. The individual samples collected from the hybrid families studied in the experiment were quite effective (Table 4).

Table 4

CHARACTERISTICS OF FIBER LENGTH OF HYBRIDS OBTAINED FROM CROSSING OF “GANJA-110” COTTON VARIETY WITH GEOGRAPHICALLY DISTANT COTTON VARIETIES

Number	*Hybrid combinations*	*Characteristics of parent couples*		*Characteristics of hybrids, day*			
		♀	♂	F_1		F_2	F_3
				M	h_p		
1	Ganja-110 × BA-440	35.0	32.5	34.8	0.8	36.0	35.0
2	Ganja-110 × Select	35.0	33.0	34.0	0.0	34.5	34.8
3	Ganja-110 × Acala Beret	35.0	32.0	33.7	0.13	34.0	34.0
4	Ganja-110 × S-6524	35.0	34.2	34.6	0.0	35.0	34.5
5	Ganja-110 × Tashauz-68	35.0	34.0	35.0	+1	34.8	34.0

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Работа поступила
в редакцию 09.01.2022 г.

Принята к публикации
12.01.2022 г.

Ссылка для цитирования:

Zeinalova A. Study of Heterosis in Hybridization of Geographically Distant *Gossypium* Varieties // Бюллетень науки и практики. 2022. Т. 8. №2. С. 91-97. https://doi.org/10.33619/2414-2948/75/12

Cite as (APA):

Zeinalova, A. (2022). Study of Heterosis in Hybridization of Geographically Distant *Gossypium* Varieties. *Bulletin of Science and Practice, 8*(2), 91-97. https://doi.org/10.33619/2414-2948/75/12