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STUDY OF SOWING QUALITY, OILINESS AND RESISTANCE TO WILT DISEASE OF SEEDS OF GEOGRAPHICALLY DISTANT COTTON VARIETIES

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Abstract. In the paper the biomorphological features of the local cotton varieties "Ganja-110" and geographically distant cotton varieties" BA-440", "Select", "Akala Beret", "C-6524", "Tashauz-68" and their adaptation to the soil and climatic conditions are studied. The selection of the most promising cotton varieties for farm households is carried out. As a result of the conducted research, it is recommended to cultivate in the farms adapted to the local soil and climatic conditions, high-yielding, more favorable for growing cotton varieties.

Keywords: *cotton, variety, geographical remoteness, vegetation period, bolls, sympodial branch, fiber yield, adaptation.*

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1. Introduction

The yield of raw cotton can be increased by applying the achievements of science and the advanced experience of cotton farming. Along with increasing productivity, great attention is paid to improving quality, planting early-ripening varieties, harvesting at optimal times, introducing new technologies, etc. The application of innovative technologies of advanced countries, including China, Greece, Turkiye and the International Atomic Energy Agency (IAEA), currently engaged in cotton cultivation in our republic, created the basis for obtaining higher production in cotton cultivation.

Comparative study of quantitative and qualitative indicators of cotton varieties cultivated in cotton farms of the republic and introduced from geographically distant countries has become relevant to find out the preferred cotton varieties and introduce them to farms.

The main purpose of the research is the study of biomorphological features of geographically distant cotton varieties, economically valuable traits and the selection of more promising cotton varieties for farming households.

2. Research methods

The studies were carried out at the experimental field of the Research Institute of Plant Protection and Industrial Plants of the Samukh region in 2017-2020. The analyzes were carried out at the General Agriculture, Genetics and Selection of the Azerbaijan State Agricultural University.

The local cotton variety Ganja110, BA-440 (Turkiye), Select (Greece), Akala beret (Israel), C-6524, introduced from cotton-growing countries, and C-6524 were used as research material. According to the taxonomy of F.M. Mauer, these varieties of cotton belong to the genus Gossypium, subtype Eugossypium, belongs to the type G. hirsutum L. and has 52 chromosomes in somatic cells.

Sowing was carried out manually according to the scheme 60 cm x 20 cm, each variety was sown in 4 rows, the length of each row was 15 meters, the repetition was 4 times.

During the growing season, field inspections were carried out 3-4 times at different stages of plant development. Phenological observation was recorded by the date of mass maturation, when at least one open bolus per plant reached 50% in the count rows.

A few days before the first collection, samples were collected from mature bolls for analysis. These samples were assumed to be in the 1st–2nd place of normal growth of 2-5 sympodial branches. From each variant, 100 bolls samples were selected by repetition at the rate of 25 bolls, collected from each sequence within 4 replanting scheme.

Laboratory analyzes were carried out on the raw cotton taken from the experimental samples.

3. Results

***Sowing quality of seeds of geographically distant cotton varieties*.** Germination ability is the ability of the seed to give sprouts that develop normally. A normal sprout is considered when the seed sprout is as long as the seed itself. Abnormally germinated seeds emerge from different parts of the sprout's shell. (Babayeva, 2012; Taghiyev *et. al*., 2019).

For seed germination, the ready-made sand passed through sieves with various meshes in the laboratory was completely roasted, then moistened with boiled water at room temperature to 60% of its water capacity (Valiyeva *et. al.*, 2021; Shim *et. al*., 2019)

Seed germination energy and germination capacity were calculated as a percentage based on the average mathematical result of two samples. In the study of the sowing quality of the seeds of geographically distant cotton varieties, it was determined that the weight of 1000 seeds of cotton varieties was 91-115 g, the germination energy of the seeds was 87-93%, the germination capacity was 91-97%, and the seeds belonged to the I-II class according to the sowing quality. The weight of 1000 seeds of the local Ganja-110 cotton variety was 115 g, the germination energy was 93%, and the laboratory germination capacity was 97%.

The sowing quality of the seeds of geographically distant cotton varieties was 93-118 grams per 1000 seeds, according to three-year average figures. In the local Ganja-110 cotton variety, the mass of 1000 seeds was 118 g, and in the S-6524 and Tashauz-68 cotton varieties introduced from Central Asia, the seeds were large, and the mass of 1000 seeds was 116 and 109 g, respectively.

Laboratory germination energy of seeds of geographically distant cotton varieties varies between 90-95%. Ganja-110 had high germination energy (95%), and Akala Beret variety had low germination energy (90%).

Among the cotton varieties studied for 3 years in the study, Ganja-110, BA-440, S-6524 and Tashauz-68 varieties meet the requirements of class I, while Selekt and Akala Beret cotton varieties meet the requirements of class II.

Thus, the 3-year average indicators of laboratory germination of cotton seeds are as follows: Ganja-110 cotton variety - 98%, BA-440 variety - 96%, Selekt variety - 94%, Akala Beret variety - 93%, S-6524 variety – 96% and Tashauz-68 variety 97% (Table 1).

Table 1. Indicators of germination energy and germination capacity of seeds of geographically distant cotton varieties

No	Cotton varieties	the year 2017			the year 2018			the year 2019			3 year average number		
		The mass of 1000 seeds,qr	Germination energy, %	Germination ability,%	The mass of 1000 seeds,qr	Germination energy, %	Germination ability,%	The mass of 1000 seeds,qr	Germination energy, %	Germination ability,%	The mass of 1000 seeds,qr	Germination energy, %	Germination ability,%
1	Ganja-110	115	93	97	117	91	98	121	100	100	118	95	98
2	BA-440	95	89	94	92	92	95	97	97	99	95	93	96
3	Select	91	87	91	93	90	94	95	95	98	93	91	94
4	Akala Beret	90	89	93	93	90	93	96	91	93	93	90	93
5	S-6524	115	90	94	115	93	95	119	94	98	116	93	96
6	Taşauz-68	105	92	96	107	95	96	114	96	99	109	94	97

Economic efficiency of geographically distant cotton varieties. The economic efficiency of planting local Ganja-110 cotton variety and geographically distant cotton varieties was compiled on the basis of technological maps in accordance with the agrotechnical measures carried out during the growing season in the field. (Aliyev *et. al.*, 2013; Kathage & Qaim, 2012). On average, 1140 manats were spent on the cultivation of one hectare of cotton field and harvest, and the selling price of 1 kg of raw cotton was 0.65 manats, and it was calculated based on the average yield. The productivity of the local Ganja-110 cotton variety was 43.8 cents/ha. The net income spent on the cultivation of cotton varieties and harvesting of raw cotton was 1707 manats, the cost of one centner of the product was 26.0 manats, and the level of profitability was 150%.

Table 2 describes these above indicators. As can be seen from the table, when comparing the economic indicators of the local Ganja-110 cotton variety and the geographically distant cotton varieties, it can be seen that the cotton varieties introduced to the country have low economic indicators. Therefore, the cultivation of Ganja-110 cotton variety in farms will give great economic benefits.

Seed oiliness of geographically distant cotton cultivars. The most valuable of the substances contained in cottonseed is cottonseed oil, which is widely used as food in the food industry. Depending on the different varieties of cotton, the seed contains 19 to 27% oil. Cottonseed oil accounts for 11-12% of vegetable oils produced worldwide. Cotton seeds are used in the production of oil, being a very important raw material for the oil-fat industry. (Snell *et al*., 2012; Vollman & Laimer, 2013) 170-180 kg of crude oil is obtained from one ton of technical sorghum. The fat content of cotton seed is determined in the laboratory using the FATE x tractor E-580 apparatus based on the State Standard of the Republic of Azerbaijan (AZS 165-2005).

It is important to study oiliness in geographically distant cotton varieties, taking into account the feature of obtaining high-quality edible oil from cotton seeds. Seed oiliness, being one of the main economic value traits, is poorly studied in genetics. Also, directional selection work was not carried out according to the specified trait. Sometimes, many cotton varieties have a high amount of oil in their seeds in addition to complex economic valuable traits, which is a result of selection. The amount of fat in different varieties depends on the formation of seeds on plants, the dynamics of oil accumulation in seeds, agrotechnical care, fertilizer background, irrigation regime and other factors. From the research studies conducted in the direction of studying the amount of oil in the seeds of geographically distant medium-fiber cotton varieties, it was found that in order to create cotton varieties with a high amount of oil in their seeds, parental forms with a high amount of oil should be used as donors in hybridization, and it is considered appropriate to conduct directional selection in the hybrid generations.

Table 2. 3-year average yield and economic efficiency of geographically distant cotton cultivars

No	Cotton varieties	Productivity, cent/ha	Cost per hectare, manat	The cost of the product purchased from one hectare of land, manat	Net income of the product from one hectare of land, manat	Cost of one centner of product, manat	Profitability level, %	Comparative economic assessment of varieties, %
1	Ganja-110	43.8	1140	2847	1707	26.0	150	100
2	BA-440	33.0	1140	2145	1005	34.5	88	59
3	Select	34.6	1140	2249	1109	32.9	97	65
4	Akala Beret	31.0	1140	2015	875	36.8	76	51
5	S-6524	36.2	1140	2353	1213	31.5	106	71

Table 3. Seed oiliness of geographically distant cotton varieties, %

No	Cotton varieties	In seed, %	In kernel, %
1	Ganja-110	27.2	46.5
2	BA-440	21.6	41.0
3	Select	2.3	40.5
4	Akala Beret	21.0	39.0
5	S-6524	26.7	45.9
6	Taşauz-68	26.3	44.0

Table 3 shows the comparison of the varieties in which the determination of total fat content in the core of the seeds of geographically distant cotton varieties was carried out.

In order to create cotton varieties with high oil content in the seeds, it is important to involve the initial forms and variety samples with high oil in the seeds for hybridization and to carry out breeding research.

Studying the resistance of geographically distant cotton varieties to wilt disease. Fungal and bacterial diseases are the most damaging to cotton plants in Azerbaijan. Wilt (withering) can be indicated for the first and hommosis diseases for the second. The main cause of cotton wilt disease is Verticillium dahlia Kleb (verticilium dahlia) fungus. The source of the disease in the cotton plant is microsclerotia in the soil and plant residues. In particular, the most infection is concentrated in the leaves up to 75%. Vertisillum wilt fungus infects medium fiber cotton varieties, mostly G. hirsutum L. species. The optimum temperature for the viability of the fungus microsclerosis, which is the causative agent of V. wilt disease, is 23-25°C.

One of the uses of these opportunities in cotton production is the prevention of damage caused by diseases and pests. (Farajova *et al*., 2012)

The causative agent of verticillium wilt disease can infect the cotton plant from the first leaf stage to the end of the growing season.

Depending on the duration of the disease, wilt causes either the complete destruction of infected plants, or disrupts their normal nutrition and reduces productivity to one degree or another. In general, this disease causes the loss of a large amount of cotton. (Mamedova, 2012; Saidov, 2014)

The edges of the cotton leaves of the geographically distant cotton varieties that we take begin to turn yellow first, and gradually the turgor phenomenon is disturbed. After two to three days, those parts get a purple-pink color and gradually dry up. In the later periods, the symptoms of the disease begin to manifest themselves with disease-specific spots on the second and third true leaves. Such plants fail to develop and die.

Table 4. Evaluation of wilt resistance of geographically distant cotton cultivars

No	Cotton varieties	Wilt-infected plants, in %					
		Total			Including		
		the year 2017	the year 2018	the year2019	the year 2017	the year 2018	the year 2019
1	Ganja-110	15,8	12,5	13,0	5,2	6,2	4,3
2	BA-440	15,4	9,1	13,3	7,7	5,5	6,7
3	Select	17,5	10,3	16,7	7,2	6,7	5,5
4	Akala beret	25,0	16,0	22,0	10,0	7,0	7,7
5	S-6524	37,5	26,7	33,3	21,0	15,3	16,7
6	Taşauz-68	29,3	23,0	26,5	16,5	13,1	14,0

The complete removal of diseased plants from the fields after harvesting can be considered as preventive control against wilt disease and leads to a partial reduction of the disease. (Abdullayev *et al.*, 2005)

In some varieties, the symptoms of the disease are still observed by the formation of red-purple spots on the edges of the leaves. The anthocyanin colors present in the leaves of Filga hinder the diagnosis of the disease. When the plant is sick, first the spots on the leaves become discolored, then those parts dry up and fail to fully develop, and finally the leaf falls off. (Lu *et al*., 2012).

In general, the appearance of verticillosis wilt disease on leaves is different. There are often cases of drying between and on the edges of the leaf veins. On the leaf surface, especially between the veins, spots similar to light yellow haze are formed, and then those spots turn brown and dry (Akimtsev, 1998).

Geographically distant cotton varieties were studied and evaluated on the background of artificial infectious wilt created in BM and TBETI. The studied geographically distant cotton varieties were sown in 2 rows in 4 replicates with the length of each patch being 10 m.

The purpose of planting and cultivating geographically distant cotton varieties in the background of artificial infectious wilt is to detect resistance to the disease and determine whether they are promising varieties for planting in farms.

It is an urgent task to study, select, collect and use forms that have disease resistance genes in breeding. For this purpose, it is important to plant selection materials in greenhouses, on artificially created infectious wilt backgrounds, and choose the ones that are durable, to carry out inter-species and intra-species hybridization with selected forms. This is the most efficient method for creating sustainable varieties.

Table No. 4 shows the assessment of resistance to wilt disease of geographically distant cotton varieties used in our research. As can be seen from the table, local Ganja-110 cotton variety is less infected with wilt disease.

4. Conclusion

It was determined that the weight of 1000 seeds of cotton varieties was 93-118 g, the germination energy of seeds was 90-95%, the germination capacity was 93-98%, and the seeds belonged to class I-II according to sowing quality. The weight of 1000 seeds of the local Ganja-110 cotton variety is 118 g, the germination energy is 95%, and the laboratory germination capacity is 98%.

The productivity of the local Ganja-110 cotton variety was 43.8 cents/ha. The net income spent on the cultivation of cotton varieties and harvesting of raw cotton was 1707 manats, the cost of one centner of the product was 26.0 manats, and the level of profitability was 150%. When comparing economic indicators of Ganja-110 cotton variety and geographically distant cotton varieties, it became clear that cotton varieties introduced to the country have low economic indicators.

Since the seeds of Ganja-110 and S-6524, Tashauz-68 cotton varieties introduced from Central Asia were larger, the amount of both kernel and total oil in the seeds was high. The amount of oil in the seed kernel of the Ganja-110 cotton variety was 46.5%, the total was 27.2%, the amount of oil in the kernel of the S-6524 variety was 45.9%, the total was 26.7%, the amount of oil in the kernel of the Tashauz-68 variety was 44.0%, and the total was 26.3%. The small size of the seeds of other geographically distant cotton varieties imported from abroad has caused the oil content of their seeds to be low.

The assessment of resistance to wilt disease of the geographically distant cotton varieties used in the research was studied. Thus, the local Ganja-110 cotton variety is less infected with wilt disease.

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